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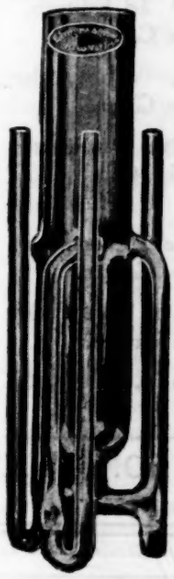

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See *Jour. of Amer. Chem. Soc., June, 1922*

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Write for Bulletin No. 291 which gives details of the apparatus.

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WILLIAM STEWART HALSTED, 1852-1922

PROFESSOR HALSTED, certainly one of the most cultivated, and regarded by many as the most eminent surgeon of his time, in view of the character of his contributions, died at noon on Thursday, the seventh of September, in the Johns Hopkins Hospital, of which he had been surgeon-in-chief since soon after its opening. At that time, in 1889, neither he nor his clinical colleagues, Osler and Kelly, had as yet turned forty.

A man of unique personality, shy, something of a recluse, fastidious in his tastes and in his friendships, an aristocrat in his breeding, scholarly in his habits, the victim for many years of indifferent health, he nevertheless was one of the few American surgeons who may be considered to have established a school of surgery, comparable, in a sense, to the school of Billroth in Vienna. He had few of the qualities supposed to accompany what the world regards as a successful surgeon. Over-modest about his work, indifferent to matters of priority, caring little for the gregarious gatherings of medical men, unassuming, having little interest in private practice, he spent his medical life avoiding patients—even students, when this was possible—and, when health permitted, working in clinic and laboratory at the solution of a succession of problems which aroused his interest. He had that rare form of imagination which sees problems, and the technical ability combined with persistence which enabled him to attack them with promise of a successful issue. Many of his contributions, not only to his craft but to the science of medicine in general, were fundamental in character and of enduring importance.

As a schoolboy at Phillips-Andover and as an undergraduate at Yale, he was prominent in sports rather than in the class-room, and in

his senior year was captain of one of the early university football teams. Like many other young men his ambition was not fired until his entrance into a professional school, and when, after his graduation in 1874, he entered the College of Physicians and Surgeons (Columbia) in New York, he settled down to prove his mettle with the result that three years later, on getting his degree, he was awarded a prize for leading his class in scholarship. After serving as interne at Bellevue he was appointed house physician to the newly erected New York Hospital. Subsequently, two years were passed in Europe where he devoted himself more especially to the subjects of anatomy and embryology. He studied at Vienna, Leipzig and Würtzburg, and his later surgical trend and investigative proclivities were distinctly colored by the German and Austrian surgery of the day.

On his return from abroad in 1880, he was made assistant demonstrator and subsequently demonstrator of anatomy at the College of Physicians and Surgeons. He also held a number of hospital positions, first at the Charity Hospital where from 1881 to 1887 he was an attending surgeon and director of the out-patient department. For three years he was also surgeon-in-chief to the Emigrant Hospital, Ward's Island; and later, from 1885 to 1887, an attending surgeon to both the Bellevue and Presbyterian Hospitals. During this period in New York, following his return from abroad, he supported himself mainly by teaching, and with Dr. George E. Munroe he organized a famous extramural course for students, consisting of practical exercises in the laboratory and at the bedside, to take the place of the time-honored quizzes which it was long the fashion for the New York students with hospital aspirations to attend.

During his last few years in New York he undertook an anatomico-surgical investigation on the anæsthetizing effect of the then little-known and newly introduced drug, cocaine. In this research, which had been begun in 1885, he was the first to utilize for surgical purposes the principle of nerve blocking, and was accustomed to demonstrate to dentists how painless extractions or even more extensive operations on the jaws might thus be carried out. He was the first, also, at this time, to demonstrate spinal anæsthesia by introducing the drug into the lumbar meninges. In the course of these studies he used himself as a subject, injecting his own peripheral nerves in order to map out the areas of anæthesia, and, unaware of the danger he was running, contracted an habituation to the drug, from which, with the help of a devoted professional friend, he effectually broke himself.

It was natural enough that cocaine was subsequently abhorred by him, and after Schleich's solution came to be generally employed as a local anæsthetic, he usually preferred to infiltrate with salt solution alone, which has certain anæsthetizing properties, rather than use even the diluted drug. Fifteen years later when the writer of this note, as Dr. Halsted's resident surgeon, stumbled anew upon the principle of nerve blocking for operations on hernia and published a paper on the subject, he was utterly unaware that his chief had ever made studies with cocaine of any sort, so reticent was he about this particular matter and so little did questions of priority interest him. It has remained for the dentists to call attention to his original work on regional anæsthesia, and a few months before his death they made due public acknowledgment of what Dr. Halsted himself had never laid claim to, and the knowledge of which he had even withheld, at least until recent years, from his house officers.

Before this tragic episode interrupted what would doubtless have been a brilliant career in New York, he had published a number of papers which showed promise of his technical gifts and abilities as an investigator, but it was not until he was brought to Baltimore in the late eighties by William H. Welch and got to work in the original pathological building there with Franklin P. Mall, Councilman, Flexner and others, that his unusual capacity for research was shown at its full worth.

The studies of compensatory thyroid hypertrophy, one of his early researches, published in the first volume of the Johns Hopkins Hospital Reports, remained for twenty years the

basis of our views regarding exophthalmic goitre as an expression of functional overactivity. The correctness of his observations and interpretation of them, indeed, remained unquestioned until he himself repeated the experiments and, failing to corroborate his original results, promptly reported the fact before one of the biological societies. It was a striking example of his scientific honesty, and it remained for someone else to point out, on the basis of new facts relating to iodine, how it was that his original interpretation had been nearer the truth than his later one.

Another of his early studies was on intestinal resection and suture, and he introduced a method of anastomosis of the bowel, based on the distribution of the blood supply and on the correct placement of the sutures, far superior to that of any of his predecessors. These two subjects, the surgery of the thyroid and intestine, continued to engage his attention to the end, and among his last publications was a monograph entitled "The Operative Story of Goitre" published two years before his death; and another on the bulkhead principle of intestinal anatomosis.

His interest lay not in the number of cases he might operate upon but in working at certain principles of surgery, and in the course of his experiments upon the thyroid and parathyroid bodies, he hit upon what is known as Halsted's Law, namely, that "a transplant of a portion of a ductless gland will survive only when a physiological deficit has been produced."

On the opening of the hospital in 1889 he turned his attention to questions of technique, and was among the first American surgeons to grasp fully the principle of the new aseptic surgery. The introduction of silver as suture material and as a covering for wounds because of its bactericidal qualities was due to him. He studied the healing of an aseptic blood-clot in closed wounds. He introduced gutta-percha in the form of "protective" as a dressing for open wounds. He showed how silk could be safely buried in the tissues, an important principle many surgeons are incapable of learning. He was among the first to insist upon absolute blood-stilling in the course of operations in days when operations were bloody affairs, and he introduced the form of delicate pointed forceps for hæmostosis now universally in use. He also introduced rubber gloves into surgery in the early nineties, and, being himself a painstaking rather than a brilliant or spectacular operator, it was long before gloves came into use in other clinics—indeed, for years they were very much scoffed at as clumsy impediments to manipulation.

His operation for cancer of the breast revolutionized the treatment of these cases, and the same might be said of his hernia operation, though in this he shared the honors with Bassini, an Italian, who introduced a high inguinal operation with repair of the canal at about the same time. In the late nineties his attention was chiefly centered upon the diseases of the gall-bladder and its ducts, and the early radical operation on the common duct emanated from his clinic. Possibly few men in the country knew more than did he about the condition from which he was destined to succumb—a stone in the ampulla of Vater.

In later years he devoted himself chiefly to studies relating to the blood-vessels and evolved a method whereby in cases of aneurysm the major trunks could be slowly constricted, and in this as in all other subjects which his studies illuminated, his inventive genius was displayed, as well as his thorough knowledge of anatomy and pathology. He was the first successfully to ligate the left subclavian artery in its first portion for aneurysm and the only surgeon who is recorded to have performed this rare procedure twice.

Halsted's honors were many. In 1900 at the centennary of the Royal College of Surgeons of England he, with J. C. Warren of Boston, W. W. Keen of Philadelphia, and Robert F. Weir of New York, were the four Americans chosen to receive an honorary fellowship. A few years later he was made an F. R. C. S. of Edinburgh, and also an LL. D. both of Edinburgh and of his alma mater, Yale. Columbia gave him a D. Sc. and he was a member of the National Academy of Sciences as well as of many other foreign and American scientific

bodies. Though his publications were comparatively few—rarely more than one or two a year—he wrote well and painstakingly, and many of his papers will remain among our surgical classics. The one surgeon he perhaps admired more than any other was the late Theodore Kocher of Berne, Switzerland, and the two men, in manner and methods surgical, in imagination and ideals, had very much in common. Both of them held their professorships for an unusual number of years—Kocher for forty-five years, Halsted for thirty-three.

Halsted was a man who taught by example rather than precept. He was a safe, fastidious and finished surgeon, by no means a brilliant and showy operator after the style cultivated by many of his contemporaries. He cared nothing for administration, and up to ten years ago at least, his staff never met as a body. He was not a successful teacher of undergraduates. A bed-to-bed ward visit was almost an impossibility for him. If he was interested he would spend an interminable time over a single patient, reviewing the history, taking notes, having sketches made, carrying the problem to the laboratory and perhaps working on it for weeks. Meanwhile his associates and assistants would run his clinic as best they could. In this way his school developed—none of his pupils after his own fashion, to be sure—it would have been impossible to imitate him—all of them, nevertheless, influenced enormously by his attitude toward surgery, and by his operative methods.

His loss to the Johns Hopkins Hospital which he served so faithfully and long, and to which he bequeathed his property, will be irreparable. It will be equally so to his many and devoted disciples. One of his long series of resident-surgeons, who, as others have done, came to know him better after leaving his service, just as many sons learn to know their fathers not until after they have grown up, has in all respect and affection written this inadequate note of appreciation.

"Who knows whether the best of men be known, whether there be not more remarkable persons forgot than any that stand remembered in the known account of time?"

H. C.

EARTH CURRENTS AND MAGNETIC VARIATIONS

WHENEVER two metallic conductors are buried in the earth and are connected by a wire through a galvanometer a current is found to flow through the galvanometer.

Such a current may be (and sometimes is) caused by a difference of electrolytic action upon, or a difference of temperature of the ground plates, but it is often much stronger than could possibly be produced by such action. It is also regularly the case that the farther apart are the ground connections the greater is their potential difference, and this would not be the case if the currents were due to electrolysis. Since no one has been able to explain these currents by any of the properties of the metallic part of the circuit, it has come to be believed that the currents are flowing in the earth before the two ends of the wire are grounded, and that the wire merely serves as another conducting path between the two earth connections and acts as a shunt for a part of the current. Thus the currents are not regarded as flowing around a circuit consisting partly of the metallic conductor and partly of the earth between its terminals, as they would flow if they were electrolytic or thermo-electric currents, but they are believed to flow in the same direction in both the earth and the metallic conductor.

Since no place has been found, either on land or sea, where these currents will not flow through a long conductor whose ends are earthed, it is believed that there are currents flowing everywhere in the outer layers of the earth's crust and in the sea.

As soon as telegraph lines began to be established it was observed that currents were often set up in these lines when no battery was connected in the circuit. In 1847, a brilliant aurora was observed in Europe and simultaneously with this telegraph lines were greatly disturbed. This led to a careful observation of the diurnal and seasonal variations of the earth currents which were known to be always present in the lines, and to the establishment of a correspondence between these variations and the diurnal and seasonal variations of the magnetic elements of the earth. Since that

time it has been known that the two phenomena are physically related, but there is, as yet, no agreement as to the exact nature of this relation.

In this connection it should be mentioned that two classes of magnetic and electric variations have been observed and are frequently, if not universally, assumed to have the same explanation. It is well known that at times of great sun-spot and auroral disturbances there are also very great and irregular magnetic and earth-current disturbances. It was these abnormal earth-currents which first attracted the attention of physicists, and it is these which have received the most attention from writers on the subject. But in addition to these there is a regular diurnal variation in both the magnetic declination and inclination and in the direction and intensity of the earth-currents. In the literature of terrestrial magnetism, variations of the irregular class are called magnetic *disturbances* while the regular daily and seasonal changes are known as the magnetic *variations*. The relation between the magnetic changes and the earth-current changes seems to be different in the two cases. Thus in the case of the magnetic *disturbances* the corresponding earth-current changes seem to be simultaneous with the magnetic changes, while in the case of the regular diurnal *variations* the magnetic changes seem to lag behind the corresponding earth-current changes by a period which may be as great as two or three hours.

This would seem to suggest that if the regular variations in terrestrial magnetism and earth-currents are related in the sense of cause and effect the irregular magnetic and earth-current disturbances are not so related, but are both apparently due to some external phenomenon which acts simultaneously upon both classes of phenomena. This fact seems not to have been heretofore recognized by writers upon the subject.

The first extensive study of the relation of earth-currents to terrestrial magnetism seems to have been started at the Greenwich Observatory in 1863. Two earth-current lines, one north and south and the other east and west, were established in that year, and continuous records of the earth-currents in these two directions were made. In 1868, Airy, the astronomer royal, published the results of his comparisons of these variations with accompanying magnetic changes. As a result of this comparison, he says:

> I think that on repeatedly examining the agreement of the two systems of curves, it is impossible to avoid the conclusions that the magnetic disturbances are produced by terrestrial galvanic currents below the magnets. . . . At the present time we are unable to say whether the records of the galvanic currents throw any light upon the origin of the diurnal variations in the magnetic elements.

In 1870 Airy published another paper in which he undertook to account for the diurnal magnetic variation, as well as the magnetic disturbances, by earth-currents; but the theoretical curve of magnetic variation which he constructed from earth-current data, while agreeing in general shape with the observed curve of variation, is not coincident with it in time.

Since the work of Airy, the most extensive comparison of the variations in earth-currents and in the magnetic elements of the earth has been made in Germany. In 1883, two underground telegraph lines, one from Berlin to Thorn and the other from Berlin to Dresden, were set apart for the measurement of earth currents, and continuous records of these currents were kept from that time until 1891. The material thus collected was turned over to Professor B. Weinstein, who, with a corps of competent assistants, went over all the records and established for the five years 1884-1888 what he regarded as the constant resultant earth-current in the region between these cities. The diurnal and seasonal variations of this current were then compared with the corresponding variations in the magnetic elements at Vienna and Wilhelmshaven. As a result of this comparison, Weinstein says:

> Personally, I have arrived at the conviction that almost the whole of the changes observed by means of a magnetometer and classed as terrestrial magnetic variations are due to earth-currents which act upon the magnetometer as a galvanometer.

Notwithstanding the very close relation which the curves published by Weinstein show

between the two classes of phenomena, his conclusions as to the immediate relation of the two have not met with universal acceptance. Very few physicists have given any attention to the study of earth-currents in recent times, and most of these have been influenced largely by their theories as to the cause back of both earth-currents and terrestrial magnetism. Some physicists, of whom Balfour Stewart is perhaps the most important, have gone so far as to reach conclusions the reverse of those of Airy and Weinstein, and to attribute the earth currents to the magnetic variations. The fact that the diurnal variations in magnetic direction and intensity which would seem to follow from the changes in the earth-currents regularly lag behind the latter certainly indicates that the current does not immediately act upon the magnetic needle, as in the case of the current and needle of a galvanometer, and as is maintained by Weinstein in the quotation given above; but that the variations of the needle follow changes in the magnetic field of the earth, and that whatever effects are produced upon the needle by earth-currents must be due to changes which these currents have produced in the magnetic field of the earth at that place.

Looked at in this way, a time lag between the changes in current and the magnetic variations growing out of them does not seem improbable. Ewing has shown that in the case of a soft iron wire placed in a magnetizing coil an appreciable time is required for the wire to become fully magnetized. Rayleigh found that with a piece of annealed iron wire only 1.6 mm. in diameter and 17 cm. long the time for complete magnetization in a weak field was from 15 to 20 seconds. Hopkinson, after an extensive study of the rate at which magnetic induction penetrates iron, says:

> Suppose a magnet such as we have here constructed, but of the dimensions of the earth, and that some almighty electrician reversed its currents in the copper coils, the magnetizing force being 2 or 3. It would take some thousands of millions of years before the rate of change of induction at the center of its core would attain a maximum.

It is perhaps not allowable to compare the earth magnetically with a sphere of soft iron, and it is plain that the variation in the magnetic elements at a given place are not due to changes in the whole magnetic field of the earth, as in that case they would occur simultaneously over the whole earth instead of moving around with the sun, as they do, but it does not seem incredible that a change in the direction or magnitude of an earth-current at a given place should require two or three hours to produce its maximum effect upon the magnetic elements at that place. In such a contingency, it seems almost certain that the *rate of change* of the magnetic field at a given time would be proportional to the current intensity at that time. If we assume this to be the case, it is possible to compute from the curve of magnetic variation the direction and relative intensity of the current which is the cause of this magnetic variation.

Thus, when a current flows from north to south below a compass needle it deflects the north end of the needle toward the west. The north-south component of the earth current at Berlin was usually toward the south, and was much stronger in the day time than at night. Its greatest intensity was usually just before noon, and its least intensity in the morning and evening. In Figure 1, the curve A is Weinstein's curve for average diurnal variation in the north-south component of the observed earth-current for the year 1884. Curve B gives the average diurnal variation in the west component of the earth's magnetic field at Vienna for the same period. It will be seen

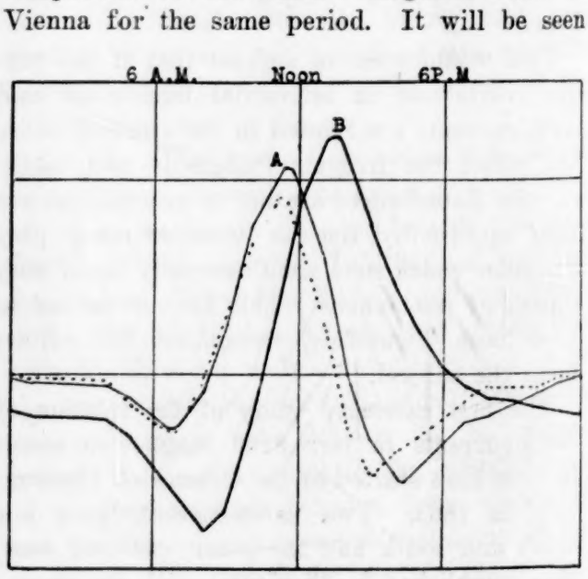

FIGURE 1

that the earth-current toward the south was strongest between eleven o'clock and noon, while the magnetic force toward the west was at its maximum between one and two P.M.

If a curve be drawn showing the *rate of change* of magnetic force throughout the twenty-four hours, we have the dotted curve, which resembles Curve A so closely as to give probability to our assumption that the magnetic deviation is caused by the earth-current, and that the magnetic force is always changing at a rate which is proportional to the intensity of the earth-current.

This relation between the rate of change of the magnetic declination and the intensity of the north-south earth-current has also been observed by Bauer[1] in data taken from the records of *Observatorio Del Ebro,* at Tortosa, Spain, but his conclusion drawn from this relation differs from that given above. Bauer says:

The general conclusion is that the north-south earth-current might be the result of electro-magnetic induction, caused by the fluctuation during the day of the west-east component of the earth's magnetism.

In reaching this conclusion Bauer has overlooked a very elementary and very fundamental law of electromagnetic induction, *viz.*, that a current induced by a change in a magnetic field is in the *opposite direction* to the current which would be required to produce the given change in the magnetic field. If the north-south earth-current and the westward deflection of the magnetic needle are causally related, the magnetic deviation is induced by the current. The contrary can not be true.

In the case of the west-east component of the earth-current conditions are somewhat different. This current weakens the magnetic component toward the north by a very small fraction of its total force, the diurnal range of this weakening being less than one two-thousandth part of the whole, and probably not all of this is attributable directly to the earth current. The resultant effect of the total earth current at a given place is to make the day side of the earth electropositive to the night side, and this condition would, of itself, weaken the north magnetic force on the day side of the earth. That is, a positive charge carried around by the earth's rotation from west to east would set up a north-south magnetic field in the opposite direction to the principal magnetic field of the earth. Such a charge would not, however, affect the east-west magnetic field of the earth.

That the day side of the earth is, on the whole, electropositive to the night side is plainly shown by a series of observations which the present writer has carried on for about three years, and for which he has continuous photographic records for more than two years. That this difference of electric potential on the opposite sides of the earth is due to the electrostatic induction of the negative charge of the sun seems beyond question. A smaller, but still a very definite effect of the moon's induction is also shown by the records.

In Figure 2, Curve A shows the diurnal variation of the earth's potential at Palo Alto for one year, from August, 1920, to July, 1921. Curve B shows the corresponding mean variation of the west-east earth current at Berlin for the year 1884. It is seen that while the earth-current reaches its maximum intensity at between ten and eleven A.M., the electropositive potential of the earth is at its maximum at between one and two P.M. In both cases the time of maximum has a seasonal variation. The same may be said of the variation in the north-south magnetic component of the earth's magnetic field, which for the year 1884 attained its maximum between eleven o'clock and noon at Vienna and Wilhelmshaven, as shown by the dotted curve C. In this case, as in the case of the variation in magnetic

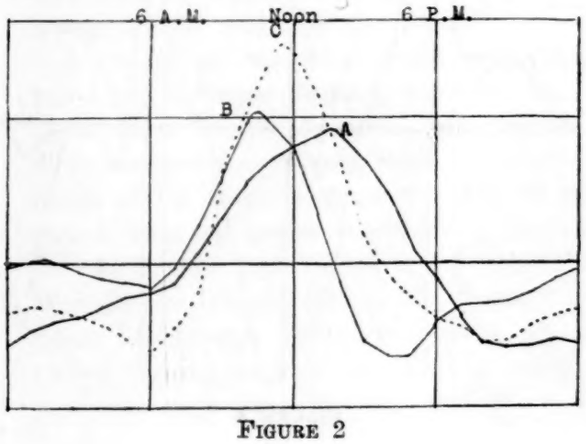

FIGURE 2

[1] *Terr. Mag.*, XXVII, 14 (March-June, 1922).

declination, the change in the earth's magnetic field is in the direction that would be produced by the change in the earth-current intensity and in the electric potential of the earth, hence the current can not be caused by the variation in the magnetic intensity.

Both the earth-currents and the diurnal magnetic variations are in the direction which they would take if they were caused by the electrostatic induction of the sun's negative charge, while the permanent magnetic field of the earth is such as would be caused by the rotation of its own permanent negative charge.

Figure 3 shows the relation between the observed mean diurnal variation of the earth-current in a line about two miles long at Palo Alto and the diurnal variation of the earth's potential for the same three days, as shown by the photographic record. On account of the disturbances in the earth due to trolley lines and other causes, and to possible disturbances in the line, which has been kindly put at my disposal by the Pacific Telephone and Telegraph Company, it is impossible to record the earth-currents photographically with any instrument at my command, and I have been compelled to make all the observations visually. As I have no assistance, I am compelled to make the continuous twenty-four hour runs myself, and for this reason I have at the present time but three such complete records, *viz.*, for June 2, July 18 and August 10, of the present year. The mean

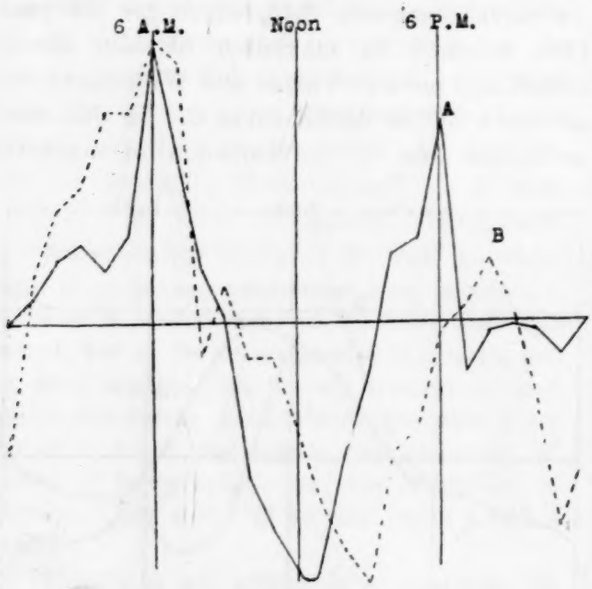

FIGURE 3

diurnal variation for these three days is shown in Curve A in Figure 3, while the mean diurnal variation in earth potential for the same three days is shown by the dotted curve, B. In this curve the signs of the potential are inverted to show better the agreement of the two curves. Both curves show many irregularities which would probably disappear in the mean of a large number of observations, but their similarity in general outline is such as to make it hard to doubt that they are physically related. Their time relation seems to indicate that the positive charge on the day side of the earth is due to the movement of electrons away from the sun.

FERNANDO SANFORD
STANFORD UNIVERSITY

RESEARCH AT THE TORTUGAS LABORATORY

THE untimely death of Alfred Goldsborough Mayor and the consequent interruption of the plans of the Tortugas Laboratory of the Carnegie Institution of Washington naturally arouses renewed interest in the work of the laboratory and especially in the investigations now being carried on there. It may therefore be desirable to bring to general notice a brief résumé of the activities of the laboratory and also to point out the purposes of some of the researches now in progress.

The laboratory has been in existence for eighteen years and during that time it has published seventeen large volumes of "Papers from the Tortugas Laboratory," with one or two volumes more in preparation. In addition, a large number of papers, based in whole or in part on work done at the laboratory, were published elsewhere, one of the most important of these being Mayor's own work of three volumes on the Medusæ. (Further discussion of Mayor's researches is found in Davenport's interesting paper in SCIENCE, August 4, 1922). Among the contributors of these papers are many of America's most productive biologists. In estimating the productive activity of the laboratory it is necessary to remember that the laboratory has been open only from eight to fourteen weeks each year and that the greater part of the work has been

done by university and college men who were busy with professional duties during the rest of the year.

An examination of these papers shows that they may be placed, for convenience, into three groups, as follows: 1, *Systematics and Distribution.* The works of Mayor on the Medusæ, Vaughan on the Corals, H. L. Clark on the Echinoderms, Treadwell on the Annelids, Cushman on the Foraminifera and others show that, contrary to general belief, the tropics still offer extraordinarily rich fields for this fundamental and important branch of biology. Work of this character, which necessarily precedes all other biological work on the organisms involved, has been carried on continuously since the establishment of the Department of Marine Biology by the Carnegie Institution. 2, *Embryology.* In the earlier years of the existence of the laboratory numerous papers were published on embryological subjects, but latterly this phase of biology has received relatively little attention, although there has been no abatement of facility or opportunity for this kind of work. The explanation of this is near at hand. It will be recalled that the laboratory was established at the time when the chief interest of biologists generally was in embryology, but that soon thereafter more and more attention was given to genetics, almost wholly at the expense of embryology. At the present time a relatively small number of descriptive embryological researches are being prosecuted. 3, *Crucial Physiological Experiments and Observations.* It frequently happens that some general conclusion based on a considerable amount of experimental or observational work already completed by one or more investigators, depends for its validity upon some crucial experiment or observation. It seems that because of the organisms, the climate or other conditions peculiar to the tropics, a large number of experimental or descriptive papers depended for their crucial data on work done at the Tortugas laboratory, or on expeditions from that laboratory to other points in the tropics.

Owing to the brief season during which the laboratory has been open each year, problems in the science of genetics, which at present occupies so large a place in biology, can not be carried on with entire satisfaction because of the fact that such work as a rule requires continuous attention for long periods.

Of the researches now in progress at Tortugas may be mentioned, first, that of Professor Longley, of Goucher College, on the coloration of reef fishes, an investigation which he has been carrying on for a number of years by means of a specially designed diving hood which enables him to study the habits of fishes in their natural environment. In addition to making important contributions to the general subject of animal coloration, he has collected what is perhaps the largest body of data in existence on feeding and other fundamental reactions of coral reef fishes. Doctor Bartsch, of the National Museum, has been engaged in breeding experiments on *Cerion,* a genus of land snails inhabiting the Florida Keys and the Bahamas, with a view to determining their specific relationships and their evolutionary history. Professor Lipman, of the University of California, has begun a comprehensive study of the activities of marine bacteria. The indications are that bacteria play as large a part in the life of the sea as they have been found to play in the life on land. It is consequently difficult to overestimate either the importance or the magnitude of this investigation. Captain Potts, of Cambridge, England, is continuing his studies, begun elsewhere, on factors influencing growth rates among various species of invertebrates. Dr. Morgulis, of the University of Nebraska Medical School, has begun a biochemical study of the blood of certain crustaceans, and finally, I may mention my own work on marine amebas, of which a monograph is now ready for the press.

A number of researches which were inaugurated at Tortugas require traveling to distant points for the successful prosecution of these researches. Among such investigations which are in progress at present may be mentioned those on marine Annelids by Professor Treadwell, who has visited a number of the West Indian Islands, Hawaii and several of the South Sea groups; Professor Harvey, who has visited various parts of the world in search of luminous organisms for his studies in bio-

luminescence; Professor Setchell, who has spent several seasons in the South Pacific in floristic studies. And in this connection must be mentioned also the unfinished researches of Doctor Mayor himself, who visited the Samoan Islands for the purpose of making observations on the rate and the conditions of the growth of corals, and who was laying plans, up to within a few days of his death, for another expedition to the South Pacific for the purpose of continuing his own and other investigations.

The life of the tropical sea presents unlimited opportunities for fruitful scientific investigation and it is the stated purpose of the laboratory to provide facilities for such investigations from a broad point of view. The published results clearly indicate that this purpose is being achieved in full measure. Students of marine biology confidently hope that the Carnegie Institution of Washington will continue to support the Department of Marine Biology so that the study of life in the sea may be continued with undiminished energy and with unrestricted scope.

A. A. SCHAEFFER
UNIVERSITY OF TENNESSEE, KNOXVILLE

THE MOUNT EVEREST EXPEDITION

IN an account of the expedition *The Geographical Journal* says that the early climbing season of 1922 was very brief. The expedition reached its base camp below the Rongbuk glacier at the end of April, when winter still held in the valley: and in the first days of June the monsoon broke and the season was over—at any rate until September. In the few weeks available there were two highly successful climbs, and a third which ended badly in the avalanche. Within six weeks most of the best climbers were out of action by frostbite, and the whole party so exhausted by the prolonged exertion above 16,000 feet that there could be no thought of renewing the attack in the autumn.

The final conquest of the mountain must wait, then, for a third year's campaign, organized in the light of this year's experience and this year's great though not complete success. Closer acquaintance with the mountain has shown that the physical difficulties are more formidable, the physiological difficulties decidedly less, than had been supposed: the organization and equipment were on the right lines and in most respects perfect. But the weather introduces each year an incalculable factor, against which the best schemes may be laid in vain.

In October those members of the expedition who went out from England will reassemble on the platform of the Central Hall to recount their adventures and to receive the hearty congratulations they have earned so well. The meeting will regret that they can not welcome and congratulate with them the four officers of the Indian service whose duty will keep them in India.

By the last reports we are glad to learn that Major Morshead is doing well, and that he will lose no more than the tips of three fingers of the frost-bitten hand. The other members of the party who suffered less are already quite recovered: several are already home and others well on their way. General Bruce with headquarters arrived in Darjeeling on August 2, and the only member of the expedition left in Tibet is Captain Noel, who has established a photographic dark-room at Gyantse, and is hard at work developing many thousands of feet of cinematograph film and a great quantity of plates and panoram films. His leisure he spends in "filming" Tibetan life and customs; and he is not due in England until the middle of October. It will therefore not be possible to show any of the film at the joint meeting of the society and the Alpine Club at the Central Hall on Monday, October 16, when General Bruce and several members of the party will give the first account of their work. A second joint meeting will be held on November 21 for the first show of the film, which will be awaited with great interest. Captain Noel did extraordinarily well in getting his cinematograph camera, fitted with an enormous telephoto lens, to 23,000 feet on the Chang La, and photographing the climbing to about 26,000 feet. He writes that the Sinclair camera and the big lens by Taylor, Taylor & Hobson have been a great success. The latter was a heavy addition to the outfit, but it saved his life in the diaster which befell the third climb-

ing party, for it proved too heavy for the climb in the new soft snow below the Chang La, and he had been compelled to turn back from the rear of the party only a few minutes before the train of porters was carried away by the avalanche.

Captain Noel in his letters mentions many difficulties in photography at extreme altitudes: the most curious is the effect of the dry Tibetan climate on the cinematograph film, which cracks and sparkles with electric sparks when pulled through the hand, so that it is necessary to work with a wet hand when threading the film on the developing frames. Happily this effect was anticipated, and the makers of the Newman-Sinclair camera succeeded in making the film run through the gate without friction, and provided open-mouthed film boxes, so that damage from electrical markings is reduced to a minimum.

The official photographs which have come home from the expedition up to the time of writing comprise about 200 quarter-plate negatives on glass, a certain number of large panorama films, and two small V.P.K. films. These are supplemented by good series of pictures taken by Dr. Longstaff and Captain Finch, which have been placed at the disposal of the committee. A selection of enlargements is shown in the Photograph Room of the society, but the record must be very incomplete until the arrival of Captain Noel in October with all the larger plates. Enlargements from these will be shown as soon as possible, and the Mount Everest Committee will probably arrange for a public exhibition of the pictures in the Alpine Club Hall after Christmas, as was done last January.

SCIENTIFIC EVENTS

NITRATES IN SOUTHEASTERN CALIFORNIA

NITROGEN is needed in large quantities for use in fertilizers, in explosives required in engineering and mining, and in munitions made for national defense in war. During the war the demand for nitrates became so urgent that every known source of them in the United States was ransacked to find enough to supply our ever-increasing needs. The world's storehouse for nitrates is Chile, but the growing menace of the submarine made it imperative to divert to other uses the shipping then engaged in the Chile nitrate trade.

Small quantites of nitrates are found in almost every region where the rainfall is very small. The most promising deposits in the United States were those in the Amargosa region, in southeastern California. Before the war some of these deposits had been examined several times, chiefly by private companies that sought to obtain capital for their exploitation, but the reports made were so conflicting that the United States Geological Survey, Department of the Interior, decided to make a careful study of all the deposits in that region.

The nitrate-bearing material, or "caliche," as it is called in California, resembles in character and mode of occurrence the well-known caliche found in Chile, but it is much poorer and thinner. It forms a layer a few inches thick that lies less than a foot below the surface, at the plane of contact between the unaltered bedrock, which there consists chiefly of beds of Tertiary clay shale and the overlying clay soil. A white powdery layer, composed chiefly of sulphate of sodium and calcium, nearly everywhere lies between the caliche and the clay soil. The caliche cuts across successive tilted beds of the underlying clay shale and is thus clearly independent of the geologic structure.

In the examination made by the Geological Survey maps and cross sections were made at many places. Scores of trenches and hundreds of pits were dug down to or into the bedrock, and the soil, caliche and bedrock were then systematically sampled. Many hundred qualitative tests and nearly a thousand quantitative analyses of the caliche were made. The commercial development of the deposits, though they are the most promising in the country, was found to be impracticable, but the results of the investigation should set at rest any uncertainties as to the nature or quantity of the nitrates in the areas examined and should serve as a guide in the exploration of other supposedly nitrate-bearing regions.

An account of this investigation is given in the Geological Survey's Bulletin 724, on "Nitrate Deposits in the Amargosa Region,

Southeastern California," by L. F. Noble, G. R. Mansfield and others.

THE DEDICATION OF THE STERLING LABORATORY OF YALE UNIVERSITY

THE dedication of the new Sterling Chemical Laboratory of Yale University will occur on April 4, 1923, during the spring meeting of the American Chemical Society at New Haven. This arrangement has just been completed by national officers of the society and officials of the Yale Corporation.

The scientific meeting will be under the auspices of the New Haven and Connecticut Valley sections of the society. Professor Treat B. Johnson, of Yale University, is chairman of the executive committee in charge, chosen from members of the two sections.

The dedication ceremony, with probably 1,500 or 2,000 members of the American Chemical Society in attendance, as well as the Yale faculty and student body, will be impressive. The new building is one of the finest in the world and is built on an entirely new architectural principle. The main building is constructed on three sides of a square, three stories high and is in harmony with other buildings on the campus. In this building are class and lecture rooms, private laboratories and offices.

Inclosed in the square is a one-story, sawtooth roof type of factory building, with movable partitions. This structure can be varied to suit the various needs of the teaching staff. It is constructed to give the maximum of light and air and is equipped so that it can be converted into several small workshops or one large shop, equal in size to a small commercial chemical plant.

The following are chairmen of the several committees for the meeting: Program, T. B. Johnson; Finance, J. S. Gravely; Dedication, John Johnston; Registration, Blair Saxton; Arrangement, A. J. Hill; Hotels and Transportation, Ralph Langley; Smoker, P. T. Walden; Reception and Entertainment, C. H. Matthewson; Publicity, W. T. Read; Ladies' Entertainment, Mrs. John Johnson. The Chi chapter of Alpha Chi Sigma is to have charge of the information service of the meeting.

THE JOSEPH SULLIVANT MEDAL

MR. BENJAMIN GARVER LAMME, chief engineer of the Westinghouse Electric and Manufacturing Company, has been nominated to be the first recipient of the Joseph Sullivant Medal of the Ohio State University. In October, 1920, on the occasion of the celebration of the fiftieth anniversary of the founding of the university, Dr. T. C. Mendenhall, a trustee and emeritus professor of physics of the university, presented a sum of money, the income of which is to be used for a gold medal to be known as the Joseph Sullivant Medal of the Ohio State University.

The conditions of the gift provide that this medal shall serve as a memorial of the eminent services in behalf of the university of Mr. Joseph Sullivant who, as a member of the first board of trustees, was influential in determining the character and future of the university. The medal is to be awarded once in five years in recognition of an admittedly notable achievement on the part of a son or daughter of the university, whether that achievement be in the form of an important invention, discovery or contribution to science, the practical solution of a significant engineering, economic or agricultural problem; or the production of a valuable, literary, artistic, historical, philosophical or other work.

Persons eligible to receive the medal shall be, in the order of preference, as follows: graduates of the university; non-graduates who have studied at the university not less than two years; members of the faculty who are not graduates of the university, who have served as such for at least ten years, when the work offered as entitling them to the award has been done during their connection with the institution.

From the list of nominations made by the faculties of the different colleges of the university, the graduate council selected three, *viz.*, George Wesley Bellows, artist; Benjamin Garver Lamme, chief engineer, Westinghouse Electric and Manufacturing Company; Herbert Osborn, research professor in the department of zoology and entomology, the Ohio State University.

The names of these three candidates were

then presented to a committee selected by the graduate council and composed of the following members: Chairman, Dr. Elihu Thompson, of West Lynn, Mass., electrical engineer; Mr. Arthur Fairbanks, director of the Museum of Fine Arts, Boston, Mass.; Dr. William Morton Wheeler, director of the Bussey Institution, Boston, Mass.

This committee, after making a thorough study of the achievements of the three candidates proposed by the graduate council, unanimously selected Mr. Benjamin Garver Lamme as the one who should receive the Joseph Sullivant Medal. The medal will be awarded to Mr. Lamme later in the year at a special meeting to be held in honor of the occasion.

INSTALLATION OF THE PRESIDENT OF LEHIGH UNIVERSITY

BEFORE an audience of delegates from other institutions, alumni and undergraduates of Lehigh University and friends of the university which crowded the Packer Memorial Chapel, Dr. Charles Russ Richards, former dean of the College of Engineering of the University of Illinois, was on October 14 inaugurated president of Lehigh University.

It was Founder's Day at Lehigh and on that day commemorating the founding of the university by Judge Asa Packer its presidents have been inaugurated. Dr. Henry R. Price, president of the board of trustees, presided. After the induction address by Bishop Ethelbert Talbot and the greetings from the alumni by Dr. Henry S. Drinker, president emeritus, and from the faculty by Professor John L. Stewart, Dr. Richards delivered an address which indicated his plans for Lehigh's future.

Dr. Richards outlined the influence on human history of discoveries and inventions. He made clear how the lack of scientific knowledge has retarded, sometimes for centuries, the utilization of known forces of nature. He traced the history of our present civilization and indicated the specific discoveries on which it rests. He outlined also the trend of education from the establishment of the University of Alexandria, and argued that industry and education must go hand in hand if we are to be saved in the future from the wasteful methods of the past.

Dr. Richards told his audience that Lehigh, for sixty years a teaching college, was to embark in the great work of engineering research when he stated, "While teaching is the obvious and apparently the chief function of a university, it should be its purpose to place scientific research in a position of equal importance with the work of instruction for the world must largely depend upon it to extend the boundaries of knowledge and to show its applications to the affairs of life."

Lehigh took this occasion to honor some of her distinguished alumni with doctor degrees. The list is as follows:

DOCTOR OF SCIENCE

William Bowie, C.E., '95, M.A., Sc.D., chief of the Division of Geodesy, U. S. Coast and Geodetic Survey.

Morris Llewellyn Cooke, M.E., '95, former commissioner of public works, Philadelphia.

Walter Savage Landis, Met.E., '02, M.S., '06, chief technologist American Cyanamid Company, New York City.

Harlan Sherman Miner, B.S., '88, Sc.D., chief chemist, Welsbach Light Company, Gloucester, N. J.

Harvey Harkness Stoek, B.S., '87, E.M., '88, Sc.D., head of the department of mining engineering, University of Illinois.

Richard Hawley Tucker, C.E., '79, astronomer, Lick Observatory, Mt. Hamilton, California.

DOCTOR OF LAWS

Manuel Victor Domenech, C.E., '88, former commissioner of the interior, Porto Rico.

Charles William Macfarlane, C.E., '76, Ph.D., economist and author, Philadelphia.

DOCTOR OF ENGINEERING

Henry Gerber Reist, M.E., '86, mechanical and electrical engineer, General Electric Company, Schenectady, N. Y.

After the inaugural ceremonies a luncheon was served to the guests of the university and later in the afternoon a reception and tea was given to President and Mrs. Richards in Drown Memorial Hall. In the evening the Lehigh Home Club gave a dinner to Dr. and Mrs. Richards in the new Hotel Bethlehem. The principal speakers at this dinner were President David Kinley, of the University of Illinois, and E. G. Grace (Lehigh '99), president of the Bethlehem Steel Corporation.

SCIENTIFIC NOTES AND NEWS

THE American College of Surgeons met this week in Boston with Dr. John B. Deaver, of the University of Pennsylvania, as president, and Dr. Harvey Cushing, of Harvard University, as president-elect.

AT a meeting of the Swedish Society of Physicians at Stockholm on October 3, it was decided to bestow the Anders Reizius' Medal on Professor Sir Charles Sherrington, of the University of Oxford, for his researches in physiology and the nervous system.

PROFESSOR BORREL, director of the Institute of Hygiene and Bacteriology at Strasbourg, formerly connected with the Pasteur Institute at Paris, has been appointed director of the Exposition of Hygiene to be held at Strasbourg on the occasion of the centenary of Pasteur.

A TABLET bearing the name "Fernow Hall" was unveiled on October 5 over the main entrance of the Forestry Building of Cornell University. This name is given in recognition of the services rendered forestry in America by Dr. Bernhard E. Fernow, who was dean and director of the first school of forestry on the American continent, the former New York State College of Forestry. Serious ill health prevented Professor Fernow being present at the ceremonies.

ON the occasion of the fiftieth anniversary of the professional career of Professor Domenico Barduzzi and his retirement from the chair of skin diseases and syphilis at the University of Siena, a gold medal was presented to him and a history of his career was published and presented to him by his students.

THE following Latin American surgeons attended the meeting of the American College of Surgeons held this week in Boston: Dr. José A. Presno and Dr. Rafael Menocal, of Havana, Cuba; Dr. Gabriel M. Malda and Dr. Unises Valdes, of Mexico; Dr. Jose Arce of Buenos Aires, Argentina; Dr. Claudio J. Sanjines, of La Paz, Bolivia; Dr. Olympia da Fonseca, of Rio de Janeiro, Brazil; Dr. Gregorio Amunotegui and Dr. Lucas Sierra, of Santiago, Chile; Surgeon General Alberto Adriasola and Dr. Guillermo E. Muennich, of Valparaiso, Chile; Dr. Pompilio Martinez, of Bogota, Colombia; Dr. Francisco Graoa, of Lima, Peru; Dr. Enrique Pouey, of Montevideo, Uruguay, and Dr. Louis Razetti, of Caracas, Venezuela.

THE Harvard faculty of medicine held a reception on October 16 for the delegation of visiting professors from the medical department of the University of Strasbourg. The visiting group is made up of Dean George Weiss and Drs. Camille Duverge, Leon Blum, Paul Masson and Maurice Nicleux. They are making under the auspices of the Rockefeller Foundation a study of the methods used in American medical schools.

PROFESSOR ERNEST MERRITT, head of the department of physics of Cornell University, has been granted leave of absence for the second half of the present academic year. His place will be taken by Professor Frederick Bedell.

PROFESSOR L. A. FITZ, head of the department of milling industry at Kansas State Agricultural College, has been granted a leave of absence for one year to work in the research laboratories of the Fleischmann Company in New York City.

GEORGE F. WEBER, Ph.D. (Wisconsin, '22), has been appointed assistant plant pathologist in the Agricultural Experiment Station of Florida at Gainesville.

DR. H. J. HAMBURGER, professor of physiology, University of Groningen, Holland, delivered an address on October 19 on "The increasing significance of chemistry in medical thought and practice" before a joint meeting of the Washington Academy of Sciences, the Biological Society of Washington and the Chemical Society of Washington. Dr. Hamburger will give an address on the same subject as the first Harvey Society lecture at the New York Academy of Medicine, on Friday evening, November 3.

DR. ARTHUR L. DAY, director of the Geophysical Laboratory of the Carnegie Institution, lectured on October 8 on "The study of earth movements in California" before the Franklin Institute of Philadelphia.

DR. C. E. K. MEES, director of the research laboratory, Eastman Kodak Company, gave an illustrated lecture entitled "Chemistry and the motion picture" before the Society of Engineers at Troy, N. Y., on November 14; the Detroit Section of the American Chemical Society on November 15; the Purdue Section, American Chemical Society, at Lafayette, Indiana, on November 16; and the Chicago Section, American Chemical Society, on November 17.

DR. W. R. HAM, head of the department of physics, addressed the Pennsylvania State College Branch of the American Association for the Advancement of Science October 18 on "Experimental evidence for and against the variation of mass with velocity and its bearing on the special theory of relativity."

L. E. WARREN addressed the American Association of Food, Dairy and Drug Officials at its twenty-sixth annual convention, at Kansas City from October 3 to 6, on the subject, "The laboratory of the American Medical Association and its work."

A STATE university for Massachusetts was the subject discussed at a public dinner meeting arranged by the Boston Ethical Society on October 16. Among the speakers were Dr. Paul H. Hanus, professor of education at Harvard University, and Dr. Arthur Gordon Webster, professor of physics at Clark University.

THE new building for the Institute of Pathology for the University of Freiburg was inaugurated in September. The address was given by Dr. Ludwig Aschoff, professor of pathology and pathological anatomy in the university, on "The importance of pathological anatomy for social medicine."

A MEMORIAL tablet was placed on the house at Tulle of the late Edmond Perrier, on September 24. The Paris Academy of Sciences was represented at the ceremonies by M. Ch. Gravier.

IT is proposed that the new 50-centime stamp which France is about to issue in compliance with the Madrid Postal Convention shall bear the portrait of Louis Pasteur, in honor of the hundredth anniversary of his birth.

DR. GUY HENRY COX, for many years professor of geology at the Missouri School of Mines, and more recently geologist for the Josey Oil Company, was killed on August 20, in an automobile accident near Bristow, Oklahoma.

JOHN FORREST KELLY, the electrical engineer, died on October 15, aged sixty-three years.

LAWRENCE REYNOLDS, an entomologist and collector in Central and South America, has died in Boston at the age of forty-four years.

THE death is announced of Professor E. Bergmann, director of the Chemisch-Technische Reichsanstalt, Berlin.

PROFESSOR EMILIO NOELTING, for many years director of the Chemical School at Mülhausen, died on August 7 aged seventy-one years.

THROUGH the will of Dr. William Frear, late vice-director of the Agricultural Experiment Station, the Pennsylvania State College has received a valuable collection of scientific books and reports which will be given a permanent place in the library of the School of Agriculture.

THE department of pathology of Columbia University has received a gift of $4,000 from the Commonwealth Fund, to be used for research into the causes of rickets.

THE *Journal* of the American Medical Association states that the Supreme Lodge, Knights of Pythias, has donated $1,000,000 for the lepers on Culion Island. This money is to be used for the following purposes: (1) Permanent living quarters to be known as "Stevens Memorial Hall" for all white lepers at the colony. (2) Erection of an experimental laboratory with full equipment to carry on experiments in search of an absolute cure. (3) Establishment of an endowment fund amounting to approximately $900,000, to provide money for carrying on the experimental work and to further the benefit work at the colony among all lepers. The amount represents an assessment of $1 on every member of the lodge, which has a membership of nearly 1,000,000 men.

IT is announced in the *British Medical Journal* that the National Council for the Promotion

of Race-renewal, which established the National Birthrate Commission, is organizing an International Congress for the Reaffirmation of the World's Moral Ideal to be held in London, October 15 to 22. The congress will be opened at Caxton Hall, under the presidency of the Bishop of Southwark, on Tuesday morning. The afternoon session, presided over by Dr. Mary Scharlieb, will discuss marriage and parenthood and the relation of the sexes, the speakers including Dr. H. Crichton Miller, Mr. C. J. Bond, F.R.C.S., and Dr. J. W. Ballantyne. On Wednesday morning the subject for consideration will be the economic, social and racial aspects of morality and the rise and fall of population, migration, etc., the speakers including Sir Arthur Newsholme, K.C.B., M.D., Dr. C. W. Saleeby and Professor William Caldwell, D.Sc., of McGill University.

THE returns of births in the ten largest towns in France for the first quarter of 1922 show a falling off of 10 per cent. as compared with the corresponding quarter of last year, the total figures being 48,528 and 53,551 respectively. No individual town shows an increase. Paris had 24,238 births, as compared with 27,489, Marseilles 6,176, as against 6,303, and Lyons 4,583, as against 5,088. It is estimated that the second quarter of the year will show a further lowering of the birth rate, as the marriage rate has been falling heavily for two years.

The Geographical Journal notes that the celebration, in April, 1921, of the death of Magellan in the Philippines, was virtually a celebration of the first circumnavigation of the globe, by far the greater part of the task—the first crossing of the vast Pacific Ocean—having been successfully accomplished solely through the initiative and hardihood of the great navigator who, by his tragic death before the finishing of the enterprise, failed to reap the ultimate reward of his achievement. But the actual first circuit of the globe was only completed on the return to Spain of the *Victoria* under the command of Juan Sebastian del Cano. This happy return of the survivors of the expedition was celebrated with much ceremony in Spain on September 5, 6 and 7, the sum of 250,000 pesetas having been voted by the Spanish government for the purpose. The celebrations took place at San Sebastian, and at Guetaria, a small fishing village some 30 kilometers to the west, which was the birthplace of Del Cano. This strip of the Spanish coast has further associations with the great voyage in that the *Victoria*, the only vessel of Magellan's fleet to complete the circuit of the globe, was built at Zarauz, which lies between Guetaria and San Sebastian. The king of Spain was expected to be present at the celebration. Institutions in other countries concerned with the progress of navigation and discovery were invited to send representatives.

THE London *Times* reports that the Danish biologists, Dr. T. H. Martensen and Dr. Hjalmar Jensen, who went in November last on an expedition to the Kei Islands, in the Malay Archipelago, with the main object of finding a suitable site for a marine biological station planned by Scandinavian biologists for the study of deep-sea fauna, have now returned to Java. The *Challenger* and *Siboga* expeditions had found in dredging operations near these islands an extraordinarily rich deep-sea fauna in comparatively shallow water. It was expected that the Kei Islands would prove a suitable spot for a laboratory. Closer investigation of the sea was, however, necessary before the site could be definitely chosen. The expedition, after having completed its task, reports considerable success. Hitherto only very few soundings had been made in the neighborhood of the islands outside the one hundred meter [fifty fathom] line. The expedition has discovered an extensive area two to four hundred meters [one hundred to two hundred fathoms] deep, near which a rich and varied deep-sea fauna may be found. It includes, beside the forms found by the *Challenger* and *Siboga*, many others new to science. It is met with at a distance of six to eight miles from the site proposed for the future station. The study of the living deep-sea animals will thus be possible with a relatively small outlay. Although, of course, a rather remote place, the Kei Islands are within easy reach. There is a regular monthly mail service from Java. The expedition carried out research work at Amboina and the Bunda Islands. These spots proved far inferior to the Kei Islands. The ex-

pedition received much courteous help from the administration of the Dutch East Indies. It was accompanied by two Dutch biologists, Dr. Siebers, ornithologist of the Buitenzorg Museum, and Dr. Boschma, who paid special attention to corals. The rich collections made by the expedition are being sent to the Copenhagen Museum.

IN connection with its studies of the distribution and movements of larval fishes and other pelagic marine organisms, the Bureau of Fisheries recently has undertaken the investigation of ocean currents of the north Atlantic coast and for that purpose has deposited about 1,500 drift bottles. These have been dropped on three lines, running, respectively, for a distance about 75 miles off Cape Elizabeth, 150 miles seaward from Chatham, Mass., and 150 miles seaward from Sandy Hook. The stations are at intervals of about one half mile, two bottles being dropped at each, with drags at different depths, the bottles being weighted so as to float with but a small part of the neck exposed. Each bottle contains a card offering a reward of 25 cents if sent to the bureau with information concerning the date and location at which it was found. Upwards of 200 of these cards have been received already. This work is being conducted in cooperation with the International Committee on Marine Fisheries Investigations, on which, in addition to the United States, the Canadian and Newfoundland governments are represented.

THE *Fisheries Service Bulletin* reports that after a period of scarcity for about twenty years menhaden have reappeared in the Gulf of Maine in considerable abundance. On the Maine coast this fishery attained its greatest importance about thirty-five years ago, with factories at various points along the coast; that is, Boothbay Harbor, Pemaquid and Round Pond. According to the bureau's local agent at Portland, the main body of fish this year were found between Portland, Me., and Massachusetts Bay, and it is doubtful whether many large schools appeared farther east than Boothbay Harbor, where about 2,500 barrels were frozen. There were landed at Portland during the month of July 1,564,800 pounds by fishing vessels and many more by smaller craft. The landings at Portland would have been much larger had not the freezers refused to accept more. A report from Boston early in August states that about 18 menhaden steamers from southern factories were operating in Massachusetts Bay. As the herring fishery this season has been a comparative failure, the stocks of menhaden were welcome to the freezers for bait, bringing nearly as much as the herring for this purpose. For bait purposes the menhaden will be used chiefly by the halibut fleet and to a lesser degree by line trawlers, cod and haddock fishermen. Reports of the presence of schools of menhaden in these waters caused the bureau to send the steamer *Halcyon* to conduct an investigation under the direction of Dr. H. B. Bigelow. Preliminary reports indicate the presence of larger quantities of diatoms, on which the menhaden feeds, than are normally found in Massachusetts Bay at this season, and it is probable that the unusually good food supply has controlled the movements of the fish into those waters.

UNIVERSITY AND EDUCATIONAL NOTES

THE will of the late Winthrop Cowdin, of Mount Kisco, N. Y., disposes of an estate estimated at more than $1,000,000. After providing for Winthrop Cowdin memorials at Harvard University and at the St. Paul's School, Concord, N. H., Harvard University receives $50,000 and the entire residuary estate, the income to be used for general purposes.

PROFESSOR HENRY GORDON GALE, of the department of physics of the University of Chicago and for ten years dean of the College of Science, has been appointed dean of the Ogden Graduate School of Science, to succeed the late Dean Rollin D. Salisbury, who occupied the position for over twenty years.

PROFESSOR MILO S. KETCHUM, professor of civil engineering in the University of Pennsylvania, has resigned to become dean of the College of Engineering and director of the Engineering Experiment Station of the University of Illinois. He will be succeeded at Pennsylvania by Professor H. C. Berry.

DR. A. M. GREENE, formerly of the Rensselaer Polytechnic Institute, has been elected dean of the Engineering School of Princeton University.

DR. G. R. LYMAN has been appointed dean of the College of Agriculture of West Virginia University. Dr. Lyman is at present in charge of the Plant Disease Survey of the United States Department of Agriculture and will assume his new position on January 1. Dr. N. J. Giddings has been acting dean of the West Virginia College of Agriculture since the resignation of Dr. John Lee Coulter on September 15, 1921.

PROFESSOR ALFRED TENNYSON DELURY, head of the department of mathematics, University of Toronto, has been appointed dean of the faculty of arts. Sir Robert Falconer called a meeting of the council of the faculty of arts and announced that, while the appointment of a dean was by statute in his hands, he would like to receive nominations from the council. Nominations were then made and balloting was carried on by mail during the next week. The result was that Professor DeLury was the choice of the council and he was appointed by the president.

DR. BOWMAN C. CROWELL, formerly connected with the Oswaldo Cruz Institute of Rio de Janeiro, and with the Bureau of Science of the Philippine Islands, has been appointed professor of pathology at the medical college of the University of South Carolina.

DISCUSSION AND CORRESPONDENCE

SOME SEISMOLOGICAL EVIDENCE THAT IS NOT EVIDENT

IN the June number of the *American Journal of Science* an article appeared under the title "A Critical Review of Chamberlin's Groundwork for the Study of Megadiastrophism."[1] In it a number of statements are made in regard to seismological facts which would seem to require experimental proof.

In the early part of the article the author sums up what he considers the evidence of seismic transmission for a viscous liquid state of the core of the earth at depths below 0.6 of the earth's radius. Describing the types of waves sent out by an earthquake, he says: "Seismic disturbances send out vibrations of two types, compressional and distortional. These are called the primary and secondary waves respectively. The former waves are dependent on the elasticity or compressibility of the transmitting medium, while the latter waves are dependent both on the rigidity and the elasticity of the transmitting medium for their propagation." In the first place, it is not clear what the author means by elasticity. He would seem to use it as synonymous with compressibility, whereas it is usually taken as a generic term including both volume elasticity and rigidity as species. But, passing over that point, does not the author's statement require both mathematical and experimental proof, since it is in direct opposition to the accepted theory of elasticity,[2] borne out as the latter is to a great extent by observations on earthquake records? As is well known, the theory of elasticity teaches that compressional, or dilatational, or longitudinal waves involve not only the modulus of compression or bulk modulus of the medium but also its shear modulus or coefficient of rigidity; and on the other hand, that the distortional, or shear, or transverse elastic waves involve the modulus of rigidity of the medium but not its modulus of compression. Thus the formula for the velocity of the longitudinal waves is

$$V_1 = \sqrt{\frac{\lambda + 2\mu}{\rho}}$$

ρ being the density of the medium, λ Lamé's compression constant, and μ the modulus of rigidity. In the case of transverse waves, the formula for the velocity is

$$V_2 = \sqrt{\frac{\mu}{\rho}}$$

Another statement that would seem to be far from evident is the following: "The two types of waves travel at different velocities but can only become distinctly separated out in a

[1] Art. XXXVII, "A Critical Review of Chamberlin's Groundwork for the Study of Megadiastrophism" by William F. Jones. *Amer. Journ. Sci.*, Fifth Ser., Vol. III, No. 18, June, 1922.

[2] *Cfr. e. g.* A. E. H. Love: "A Treatise on the Mathematical Theory of Elasticity," Rev. Ed., 1920, Cambr. U. Press.

homogeneous medium; that is, homogeneous as to stress effects or, in other words, isotropic. The resultant vibrations which travel circumferentially from the shock center pass through what we know is a heterogeneous medium." Rudzki[3] has shown that a disturbance in a heterogeneous but stratified elastic solid will send out distinct types of waves. These waves will be propagated through the stratified medium at different velocities and will appear in separate groups. First a nearly longitudinal phase will arrive at a given point, then a double, approximately transverse phase, and finally a group of surface waves will travel on the free surface.

But when the author of the article goes on to say: "The wave types are not separated in the earth's surficial shell. At a minimum distance of 700 miles, or 10 degrees of arc, from the epicenter a three-phase record becomes decipherable," he is unfortunately allowing himself to be betrayed into statements at variance with a great and ever-increasing mass of observed and published facts. The reports of any of the better seismographic stations, equipped with modern damped apparatus, would have furnished him with examples to the contrary. So, too, would any of the bulletins that are being issued by the Seismological Committee of the British Association[4], or Angenheister's[5] recent study on Pacific earthquakes and the upper layers of the earth's crust. The Chittenden,[6] California, earthquake of July 24, 1921, was an unusually beautiful example of clean-cut separation of the three phases at very short distances. As published in the Bulletin[7] of the Seismographic Stations of the University of California, the epicentral distance obtained from the Berkeley seismograms was only 125 km. (78 mi.) and that measured on the Lick records was but 46 km. (29 mi.), both of which agree very well with the location of the epicenter at Chittenden on macroseismic evidence.

There is another argument in the paper that is open to controversy. Relying on the statements of Professors Knott and Oldham that compression waves are transmitted through the core of the earth while shear waves are not, the author argues to a viscous fluid state of the interior. Now it is by no means certain that the transverse waves do not pass through the core of the earth. Neither, on the other hand, is it an observed fact that the longitudinal waves do so penetrate. In fact, the evidence seems rather strong to the contrary. Weichert and Zoeppritz,[8] Zeissig[9] and Mohorovičic[10] were not able to trace the direct longitudinal waves much more than half way to the antipodes. Gutenberg[11] in 1914 followed them up to about 106° and thought he had evidence for their reappearance between 143° and 180°.

[3] M. P. Rudzki: 1. "Parametrische Darstellung der elastischen Welle in anistropen Medien," *Bull. Acad. d. Sciences de Cracovie,* 1911, pp. 503-536.

2. "Sur la propagation d'une onde élastique superficielle dans un milieu transversalement isotrope," *Ibid.,* 1912, pp. 47-58.

[4] "The Large Earthquakes of 1917," Oxford, 1921.

[5] G. Angenheister: "Beobachtungen an pazifischen Beben. Ein Beitrag zum Studium der obersten Erdkruste," *Nachr. d. Ges. d. Wiss. zu Göttingen, Math.-Phys. Kl.,* 1921.

[6] Located at Chittenden, Santa Cruz Co., Cal., by Wm. J. Kemnitzer. See: William J. Kemnitzer, "The Chittenden Earthquake of July 24, 1921," *Bull. Seism. Soc. Am.,* Vol. XI, pp. 189-191, September-December, 1921.

[7] James B. Macelwane: "The Registration of Earthquakes at the Berkeley Station and at the Lick Observatory Station, April-September, 1921," *Univ. of California Publ., Bull. of the Seism. Stat.,* Vol. 2, No. 2, 1922.

[8] E. Wiechert und K. Zoeppritz: "Über Erdbebenwellen I u. II," *Nachr. d. K. Ges. Wiss. zu Göttingen, Math.-Phys. Kl.,* 1907.

[9] K. Zeissig: "Tabelle," Akad. Nauk, St. Petersburg, Comptes rendus des séances de la Commission sismique permanente, Tome III, Liv. III.

[10] S. Mohorovičic: "Die reduzierte Laufzeitkurve. II. Mitteilung: Die Ausbreitung der Erdbebenstrahlen in den tiefen Schichten der Erde," *Gerlands Beiträge zur Geophysik,* Bd. XIV, Heft 3, 1916.

[11] B. Gutenberg: "Über Erdbebenwellen VII A. Beobachtungen an Registrierungen von Fernbeben in Göttingen und Folgerungen über die Konstitution des Erdkörpers (mit Tafel)," *Nachr. d. K. Ges. d. Wiss. zu Gött., Math.-Phys. Kl.,* 1914.

But Rudolf and Szirtes[12] and Angenheister[13] have since shown that the latter belong to a branch of the first reflected waves. However, Angenheister was able to follow the direct compressional waves to about 145°, which is a great achievement. Beyond this we have no proof for their existence as yet. Hence it will be seen how weak is the author's argument for a viscous fluid state of the earth's core. If it is a viscous fluid, the longitudinal waves should be transmitted and the transverse waves should not. If it is an elastic solid, both the longitudinal and the transverse waves should be able to traverse it along some path, not necessarily a straight one. Do they? Future investigation may tell us. For the present, modern seismologists and geophysicists[14] suppose the core of the earth to be a rigid solid.

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THE BEGINNING OF AMERICAN GEOLOGY

TO THE EDITOR OF SCIENCE: I have been reading with very great pleasure Dr. J. M. Clarke's interesting account of the beginnings of American geology in his life of James Hall, which has recently been published.

On page 218 he refers to the statement that Charles T. Jackson "drew a plan for the New York Survey, a statement repeated in Appleton's Cyclopedia of American Biography" but concerning which he (Clarke) has "never seen documentary evidence."

Without in any way desiring to dispute Dr. Clarke's contention it may be worth while to say that the sketch in the Cyclopedia referred to was written by me and that a proof of the sketch received the approval of one member of Jackson's family. The circumstances are quite clear in my memory. Owing to Jackson's death I did not know to whom to send the proof until, telling my trouble to Henry Carrington Bolton, he called my attention to the fact that Jackson's son or nephew had been with him in the class of '62 in Columbia. This information resulted in my submitting the sketch to some proper person who not only approved the article but sent me a portrait of Jackson showing him seated on a chair with both hands on his knees extending outward holding medals.

It is possible that the item about the New York Survey came from the younger Silliman's masterly article on the "Contributions of American Chemists" that he delivered at the Centennial of Chemistry held in Northumberland in 1874, and which was published in the *American Chemist*. If so, then the information came to Silliman directly from Jackson.

May I add for the information of students of the history of chemistry in America that Jackson received pupils in his laboratory in Boston, just as Booth and Garrett did in Philadelphia, and that it was in his laboratory that Charles A. Joy, who later held professorial appointments in Union and Columbia, received his early knowledge of chemistry before going to Göttingen.

Dr. Clarke persists in writing O. M. Mitchel's name with two l's. Mitchel was a very remarkable man and like Jackson was conspicuous for not being able to carry out the great things that he had in his mind. He died of yellow fever during the Civil War, and, while holding important commands, so persistently pestered Halleck with plans and recommendations to cut the Confederacy in two that he was removed and sent to Hilton Head.

If Dr. Clarke should issue a second edition of his valuable contribution to the history of science, I would suggest that Newberry's connection with the Sanitary Commission was rather administrative than medical, as can be seen by his printed report of which a digest appears in the article on Newberry in the "Cyclopedia of American Biography."

The unfortunate experiences of many of the early State surveys has been very fully told by Merrill in his valuable "History of Ameri-

[12] E. Rudolf und S. Szirtes, *Phys. Zeitschr.*, August 1, 1914.

[13] *Op. cit.*, pp. 11, 24, 27.

Also: G. Angenheister: "A study of Pacific Earthquakes," *The New Zealand Journal of Science and Technology*, Vol. IV, No. 5, 1921, pp. 216-217, 224.

[14] *Cfr.* A. Sieberg: "Aufbau und physikalische Verhältnisse des Erdkörpers unter besonderer Berücksichtigung der Erdrinde," *Geologische Rundschau*, Band XII, Heft 6/8, 1922, pp. 346-359.

can State Geological and Natural History Surveys" but those of us who were so fortunate as to be students under Newberry can never forget the time when, owing to the changes in political administration in Ohio, he found himself displaced by one of his subordinates. Newberry had chosen from his pupils promising young men such as Hooker, Irving, Newton and others who worked up the results of their field work at Columbia under Newberry's immediate supervision. That the work was not done in Ohio was urged against it and he was forced out of his office as state geologist. It was the beginning of the end, and dear "old Uncle John" never recovered from the blow.

Perhaps in connection with these statements about Newberry it may be worth while to recall the first time I ever saw Hall. The National Academy of Sciences held its fall meeting in 1877 at Columbia University, and it was the last meeting over which the distinguished and venerable Henry presided. It was the only time that I ever saw that great outstanding figure in American science and I shall never forget the dignified manner with which he held the chair. I also recall the dapper appearance of T. Sterry Hunt, who never missed an opportunity of saying something about every paper presented.

In the afternoon a meeting had been arranged for the geologists in Newberry's lecture room in the old School of Mines building on Fourth Avenue, at which Hall was to present a paper. As I recall the experience, he spoke without notes and undertook to explain the relation between certain strata in New York State and how they extended into the neighboring State of Ohio. When he had finished, Newberry promptly contradicted his assertions, contending that while Hall might know all about the geology of the State of New York, yet the conditions in Ohio were not as he represented them to be. Then followed a scene somewhat similar to the one described by Dr. Clarke, in which Hall agreed to eat his hat, for in this outburst he expressed a willingness to wager any amount on the correctness of his assumptions. To which Newberry retorted that it was not a question of a wager or money but simply a question of facts, and that in this case the facts in Ohio failed to substantiate Hall's point of view.

Of course our sympathies were all with Newberry, for we felt that as state geologist of Ohio he ought to know what the conditions were in Ohio better than any one else. I wonder who was right?

MARCUS BENJAMIN

AN OPPORTUNITY

PROFESSOR W. N. BOLDYREFF, M.D., for ten years chief assistant to the famous Russian physiologist, Pavlov, in Petrograd; from 1912 to 1918 professor of pharmacology in Kazan University and for two years lecturer in physiology in the universities of Tokyo, Kyoto and Osaka; recipient of several Russian and German prizes and honors for scientific work; author of about fifty scientific papers mostly on the physiology of digestion, some of which have been translated into English, French, German, Swedish, Spanish, Czech and Japanese, and associate editor of several Russian, German and English medical and pharmacological journals, is now in this country, without a position, and in real distress. He is most anxious to find a place in some American university or medical school. His special lines of work are physiology, biochemistry and pharmacology. He has also worked in therapeutics and surgery and analyses of water, foods and medicines. He has an offer of a position in a European university, but is unable to find means to go to Europe. He would be glad to receive even a temporary position as professor, lecturer or laboratory worker.

I have written to the heads of several American universities on behalf of Dr. Boldyreff, but his need is so urgent that there is no longer time for me to continue, by correspondence, the rounds of our institutions. Hence I take this means of calling the attention of university and medical school authorities to what seems to me an admirable opportunity not only to obtain the services of an unusually competent physiologist and pharmacologist, but to save a scientific man of merit from utter depair and whatever its consequences may be.

VERNON KELLOGG

NATIONAL RESEARCH COUNCIL,
WASHINGTON, D. C.

SCIENTIFIC BOOKS

Aus meinem Lieben. Von Emil Fischer. Verlag von Julius Springer, Berlin. 201 pages. 3 figs. Price $2 (about).

Fischer wrote this biographical sketch while recuperating from the "flu." "Geschrieben in dem Unglücksjahre 1918," he writes; and this sentence gives us an idea of what Germany's downfall meant to Germany's greatest chemist. The sketch is an incomplete autobiography; he died in the midst of writing it; but it gives us a very intimate and, to me, fascinating picture of one of the great ones in our field. Not much is said of the chemistry of the sugars, fats and purines, but very much is said of the laboratories in which the chemistry of these substances was elucidated, and very much more is said of the men, aside from Fischer, who were active in these laboratories. With this book in our hands we need not cross the ocean to know all about Munich, Strassburg, Erlangen, Würzburg and Berlin. Noteworthy pen pictures of Fischer's intimates, such as Baeyer and Victor Meyer, are also given us.

Two paragraphs in the book that are of peculiar interest to Americans must receive comment here. We shall make a free translation of both these paragraphs:

"One day an American professor of physiology made his appearance. A rich man had entrusted some money to him with the object of founding a university in Worcester, U. S. A. The professor had the rather romantic notion of filling an entire ship with European professors, assistants, apparatus, chemicals, etc., and bringing the ship and baggage to America. He opened his conversation with me by asking me whether I would be willing to accompany him to America, there to become one of the professors at the new institution. I was too amazed to reply, and thought the whole thing a huge joke until he very carefully and very earnestly outlined his entire plan to me. He proved to be a worthy gentleman, and had much of interest to tell me.

"Soon after this an American lady, 'Miss Helene Abott,' appeared on the scene. A personal attendant who accompanied her proved to be a negress. The lady wanted to enroll as a student, and was quite astounded to find that women were not admitted to the courses. I showed her around the laboratory and introduced her to the younger men, Knorr, Wislicenus and Tafel. Her intelligent comment showed that she possessed a sound theoretical background. After her departure the discussion arose among us as to whether we ought to approach the university senate so as to get the necessary permission to allow the girl to work in the laboratory. One or two individuals were very much for her, but it did seem to the rest that the introduction of the female element into the laboratory would disturb the otherwise harmonious surroundings. Since the majority ruled against her, I wrote her to that effect. Her letter in reply was courteous, but it did not lack energy. She commented rather severely upon the backwardness of Germany in preventing women from getting a higher education."

The book is a treasure "for those who like that kind of thing." Can he call himself a chemist who does not?

BENJAMIN HARROW

NOTES ON METEOROLOGY AND CLIMATOLOGY

A NEW AEROLOGICAL SUMMARY

FOR many years, the free air has been recognized as the abode of many interesting phenomena, and much information has been gained concerning the distribution of the meteorological elements above the earth's surface. But, in the United States, with the two exceptions of the Blue Hill Observatory, associated with Harvard College, and the Mount Weather Observatory, maintained for about seven years by the United States Weather Bureau, there had been only sporadic efforts at upper-air investigation previous to the World War.

Free-air data stand in close relation to aeronautical activities, but their usefulness is by no means so restricted. The relation between surface weather and conditions in the free air is one that is coming to be recognized by the weather forecaster to an increasing degree, although the lack of aerological stations is a serious obstacle to a comprehensive correlative knowledge of these conditions. It is necessary, therefore, to extend, as rapidly as possible, the network of aerological stations in the

United States, and to summarize and publish the accumulated data at such intervals as seem convenient. In this way, we need not sit idly awaiting that golden day when we may trace upon the daily chart the coursing of the air streams above our country, but may study the results of observations thus far obtained.

The Aerological Division of the Weather Bureau, Mr. W. R. Gregg in charge, has recently summarized and published the results of observations at the several kite stations of the Weather Bureau, under the title "An Aerological Survey of the United States, Part I. Results of observations by means of kites.[1]

In addition to the summarizing of data, a useful contribution has been made in the portion dealing with the "standard atmosphere." The "standard atmosphere" is a term which has come into general use among aeronautical engineers and artillerists, and denotes the general or average condition of the atmosphere with respect to temperature, pressure, and density, to as great heights as are employed in the several fields. As far as aviation is concerned, there is a relatively large amount of data available for the maximum height at which flying is likely to occur, but the great maximum ordinates employed in ballistics require a knowledge of conditions to much greater heights.

It is true that at no time does the standard atmosphere exist, but it does afford at all times a standard from which the departures will be quite small. Several plans have been offered in various countries to satisfy the need for such an average atmosphere, as, for example, the "isothermal atmosphere." But, owing to the dependence of atmospheric pressure and density upon the vertical distribution of temperature, and the importance of the temperature factor in power production calculations with reference to air-craft engines, as well as in the design of air-craft instruments, it has been thought best to base the standard atmosphere upon the standard lapse rate of temperature.

Up to 10 kilometers, Toussaint's formula,

$$T = 15 - 0.0065Z,$$

in which T is the temperature in degrees, Centigrade, and Z the altitude in meters, holds for the mean annual values, and is very satisfactory, providing, as Mr. Gregg says, "one set is deemed sufficient for use throughout the year." This formula has been adopted in France, Italy and England. Where values are needed for both winter and summer, new tables have been provided which will be more satisfactory than Toussaint's formula.

It happens that the aeronautical research stations and artillery proving grounds of the army and navy are all within three degrees of latitude 40° N. Moreover, three of the Weather Bureau kite stations are equally close to this parallel, and from these three stations, means have been computed up to five kilometers. Above five kilometers, sounding balloon data obtained at St. Louis (1904-1907) and at Fort Omaha (1911 and 1914) have been used. From the base of the stratosphere (about twelve kilometers) up to twenty kilometers, the greatest altitude considered, a constant temperature of —55° C. has been used. The pressures for the various levels were then computed by means of the hypsometric formula, making proper allowance for the water vapor content of the air and the variation of gravity with altitude and latitude.

The discussion of the standard atmosphere appears in both the *Aerological Survey* and in Report No. 147 of the National Advisory Committee for Aeronautics,[2] the latter being in

[1] *Monthly Weather Review Supplement No. 20.* Copies of this *Supplement* may be obtained from the superintendent of documents, Government Printing Office, Washington, D. C., at 25 cents each. Mr. Gregg has made a very full abstract of this work and published it in the *Monthly Weather Review* for May, 1922. Reprints of this abstract may be obtained gratis upon application to the chief of the Weather Bureau, Washington, D. C. It is believed that this abstract will satisfy the needs of all those who have an academic or popular interest in the work. Many of the charts are reproduced, but the tables are omitted and the discussion of the standard atmosphere is very much condensed.

[2] Gregg, Willis Ray: "Standard Atmosphere." 11 pp., 4 figs., 6 tables. Copies may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at five cents each.

somewhat greater detail than the former. These publications bring together the best data available approximately representative of latitude 40° in central and eastern United States; they carry the values to altitudes that are much higher than aviation will ever need, and which will only be exceeded by the ordinates of the most extraordinary trajectories in artillery practice.

Turning again to the *Survey*, we find that the information is conveyed largely by charts and tables. The former present the matter as a whole, showing the vertical and geographical distribution of the several meteorological elements over the entire central and eastern United States. The latter are more precise, and are so conveniently arranged that the basic computational material for innumerable aerological studies may be found there awaiting the student. The text is brief, but clear and cogent, and calls attention to the significant features of the "survey."

The summary is based not only upon the kite stations of the Weather Bureau at present operating (Due West, S. C., excepted, since this station has been in operation only about a year and a half) but also upon the records of the Blue Hill Observatory and the Mount Weather Observatory. Thus data from eight aerological stations fairly well distributed, whose records vary from about two to seven years, have formed the basis of the survey.

The author shows that the values based upon a five-year record do not vary to any significant extent from those based upon a three-year record. As one might expect, the differences between the averages of the three and five-year record

> . . . are greatest at or near the surface, where they amount in a few cases to 2° C., in temperature, 1 mb. in barometric pressure and vapor pressure, and 10 per cent. in relative humidity. Differences in density are in no case significant. The seasonal means of all elements naturally show better agreement than the monthly means, and the annual means for the shorter and longer period are almost identical. It is thus evident that for the determination of *normal* values, particularly those for the months, a longer series of observations is necessary than that upon which the present summary is based.

Nevertheless, it is deemed satisfactory, for practical purposes, to regard the present means as normals. The author explains further that a longer record is necessary for the northern than for the southern stations, for the winter than for the summer (owing to the greater variability at the colder stations and in the colder season), and at lower than at higher altitudes above the surface. Thus, while 20 to 40 years are desirable lengths of record for surface data, a much shorter period is necessary for the upper levels.

To attempt to present in abstract the many striking and interesting features of the numerous diagrams would be impossible, owing to the concise presentation in the original. The large field of information is indicated by the following topics selected from the legends: Seasonal average temperatures, relative humidities, vapor pressures, for each station from the surface to about five kilometers; geographical distribution of mean summer and winter and annual barometric pressures, temperatures, relative humidity, vapor pressure, density and resultant winds; means seasonal wind velocities and the percentage frequency of different wind directions. All of these data extend from the surface to levels three to five kilometers above sea-level.

The study of aerological data is two-fold, embracing average conditions and current data. This publication from the Aerological Division of the Weather Bureau forms an admirable contribution to the former field. Such contributions form a setting for the study of current data. But, in spite of the resounding challenge of the upper air to the forecaster, the adequate and complete application of current aerological data must await the extension and amplification of the aerological *réseau*.

C. LEROY MEISINGER

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SPECIAL ARTICLES

DEFICIENCY OF ATMOSPHERIC DUST IN COAL

IN connection with studies in eolian sedimentation the writer recently has become interested in an apparent discrepancy among (1) the rate of deposition of atmospheric dust, (2)

the amount of ash in coal and (3) the rate of accumulation of vegetation leading to the formation of coal. To the casual observer it appears that there is not enough mineral matter in average coal to allow for the amount of atmospheric dust which would be deposited with the vegetation in the time ordinarily assumed to be required for the accumulation of vegetable matter in coal.

From everyday observation the universal presence of atmospheric dust is apparent. The work of Free,[1] Huntington,[2] Reid[3] and others emphasizes the quantity as being much greater than commonly supposed. However, it is not the amount of dust *in* the air, but the amount that is *caught* in standing water or by vegetation that is significant in the present connection.

An average of the analyses of ash content for representative coals of the United States given by M. R. Campbell[4] shows the following:

GRADE OF COAL	PERCENTAGE OF ASH
Lignite	8.25
Sub-bituminous	7.8
Bituminous	8.7
Semi-bituminous	8.7
Semi-anthracite	11.75
Anthracite	13.7

The last two averages are based only upon a few analyses.

It has been stated in text-books that about 9,000 years is required for the accumulation of sufficient vegetable matter to make one foot of bituminous coal. There is no reason to believe that this estimate is not at least approximately correct.

If dust was deposited from air during the coal-making periods at a rate of 1/1000 inch per year—which at the present does not seem excessive—9 inches of dust would be accumulated during the period of 9,000 years. Consequently, with every foot of bituminous coal there should be 9 inches of atmospheric dust; that is, every foot of average coal would be about 75 per cent. dust. Even 1/10000 inch of dust a year would result in coal with 7½ per cent. dust. And this does not take into account the vegetable mineral matter!

Apparently the problem leads to three questions: (1) Is the importance of dust grossly exaggerated? (2) Has the time so commonly assigned to the accumulation of a foot of coal been overestimated? (3) Were the areas which would serve as sources for dust during the coal-forming periods—and especially the Pennsylvanian—exceedingly restricted? The articles cited above emphasize the presence of dust in a way to induce the reader to believe that the importance of atmospheric dust has been overlooked rather than overestimated. If the time allotted for coal formation is fairly accurate, we would be led to believe that the sources and perhaps the means of transportation of dust were very much restricted and that the current evidence for a fairly moist, uniform climate on a land surface heavily covered by vegetation and restricted in area, becomes better established.

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[1] Free, E. E.: "Movement of Soil Material by the Wind," U. S. Dept. of Agriculture, *Bull.* 68.

[2] Huntington, E.: "The Pulse of Asia."

[3] Reid, Clement: "Dust and Soils," *Geol. Mag.*, N. S., December, III, Vol. I, 1884, p. 165.

[4] Campbell, M. R.: "The Coal Fields of the United States." General Introduction, *U. S. Geol. Survey, Professional Paper* 100-A.

THE AMERICAN CHEMICAL SOCIETY

(Continued)

DIVISION OF ORGANIC CHEMISTRY
H. T. Clarke, *chairman*
Frank C. Whitmore, *secretary*

The selective activation of alumina for decarboxylation or dehydration: HOMER ADKINS. In seeking experimental verification of the idea that the activity of a catalyst for an organic reaction in a heterogeneous system is conditioned by the magnitude of the distance between the atomic nuclei of the solid catalyst, five distinct kinds of alumina have been prepared from the aluminum alkoxides, aluminum hydroxide and hydrated alumina. It has been shown that the size and shape of the alkoxyl group is a determining factor in the relative extent to which decarboxylation or dehydration is induced in esters, alcohols and acids by the alumina prepared from the solid alkoxides. An increase in "molecular porosity,"

i. e., of the distances between aluminum atoms in the solid, is favorable to decarboxylation and unfavorable to alkene formation.

On the synthesis of thiazolidine and thiazane derivatives: F. B. DAINS, R. Q. BREWSTER, J. S. BLAIR and W. C. THOMPSON. The present report is part of a larger investigation. The immediate object of this part of the work was to devise methods for the synthesis of thiazolidine and thiazane derivatives of known structure. This was accomplished as follows: (1) The addition of mustard oils, RNCS, to aryl-allylamines, $RNHC_3H_5$, formed diaryl-allyl-thioureas, which by the action of acids were converted to 2-aryl-imino-3-aryl-5-methyl thiazolidines. (2) Aryl-N-ethanols, $RNHCH_2CH_2OH$, gave with arylisothiocyanates and cyanates ureas which condensed easily to thiazolidines and oxazolidines. (3) From aryl-N-propanols and mustard oils were obtained thioureas and then thiazanes, $SC(NR)NRCH_2CH_2CH_2$. (4) Alpha-arylamino-beta-hydroxl-gamma-chloro-propane combined with aryl mustard oils to give 5-hydroxythiazanes.

Urethanes from chlorine-substituted secondary and tertiary alcohols: LESTER YODER. Certain tertiary alcohols, for example, trichlorotertiary butyl alcohol, which do not react directly with phosgene, give the chlorocarbonates when the dilute solution in benzene is treated with sodium and then with phosgene. The products react readily with ammonia and with aniline chloral condenses with glycerol to form a substituted 1, 3-dioxole. The readiness with which this product reacts with phosgene indicates a primary rather than a secondary hydroxyl, hence the assumption of a five-membered rather than a six-membered ring. This dioxole derivative and some of the chlorine substituted urethanes prepared were found to have hypnotic properties.

Gamma-chloropropyl urethanes and a synthesis of the 1, 3-oxazine ring: ARTHUR W. DOX and LESTER YODER. Gamma-chloropropyl alcohol reacts readily with phosgene to form a chlorocarbonate, and the latter reacts ammonia and with aniline to form the carbamate and the carbanilate respectively. Removal of hydrochloric acid from gamma-chloropropyl carbanilate results in the formation of the six-membered 1, 3-oxazine ring. This reaction is analogous to that studied by Otto and by Johnson and Langley in which the beta-halogen alkyl carbanilates lose hydrochloric acid and form the five-membered 1, 3-oxazole ring.

Removal of iodine from aromatic iodo compounds, and its bearing on electromerism: BEN H. NICOLET and REUBEN B. SANDIN. Several new derivatives of 2-iodo-4-aminotoluene are described. With stannous chloride and hydrochloric acid, iodine is removed from m-iodoamino derivatives, as well as from o-iodoamino compounds; but the rate of removal is some hundreds of times slower. The results are explained on the basis of a one-sided reaction taking place on a mixture of electromers. The behavior of such a mixture is discussed.

The spontaneous decomposition of unsaturated aliphatic iodochlorides: L. B. HOWELL. Previous work (*J. A. C. S.*, 42, 997-9) upon iodochloride-1, 2-dichloro-2-iodoethylene and iodochloride-2-chloroethylene has shown that their spontaneous decompositiion is not accompanied by loss of chlorine (*cf. Ann.* 369, 135). Further investigation has shown that the expected shift of the 2 Cl atoms from the group $—ICl_2$ to the double bond is not the only change involved. Thus, when $CHCl = CHICl_2$ decomposes the products include $C_2H_2I_2Cl_2$ and $C_2H_2Cl_4$ as well as $C_2H_2Cl_3I$ (in addition to iodine monochloride and free iodine). Evidently either iodine chloride or chlorine may add to the residue —CHCL—CHCL— or iodine may be entirely replaced and the residue chlorinated. The compound $Cl_2ICCl{=}CCII$ upon decomposition gives $C_2Cl_2I_2$, C_2ClI_3 and what is apparently a constant boiling mixture of C_2Cl_6 and C_2Cl_3I. Constants for the new halo-ethanes and ethenes have been determined.

The chlorination of 2-amino-p-cymene: A. S. WHEELER and J. V. GILES. p-Cymene was obtained from spruce turpentine. It was nitrated at 0° and reduced. The acetyl derivative was chlorinated at room temperature in carbon tetrachloride solution. The product contains one chlorine. This is in position 5 as shown by its conversion into 2, 5-dichloro-terephthalic acid. Salts of the chloro aminocymene were prepared. By diazo reaction a new chloro carvacrol was prepared. The amino group was also replaced by the carboxyl group, yielding a new benzoic acid. A new series of dyes was prepared by coupling with the following: phenol, resorcinol, salicylic acid, alpha naphthol, beta naphthol, naphthol-2-sulfonic acid, 1-naphthol-4-sulfonic acid, 2-naphthol-7-sulfonic acid. A variety of colors was obtained, some of great brilliancy. The amino chlorocymene was also coupled with itself, forming a neutral compound. By oxidation a new cuminic acid was obtained.

The catalytic preparation of divinylacetylene: J. A. NIEUWLAND. Acetylene is passed into a solution of cuprous chloride (three parts), ammonius chloride (one part) and water (one part). The absorption takes place indefinitely, and when subsequently distilled, a mixture of oils comes

over. The one which distills over at 54° C. is presumably vinylacetylene of the formula, $CH_2=CH—C=CH$. Between 75° and 95° a highly refractive oil, of formula C_6H_6, supposed to be divinylacetylene, comes over. About one kilo of the above liquid is used in each flask. After repeated distillations the mixture continues to absorb the gas even for years without deterioration of the catalyst. About 80 to 110 g. of product are obtained at each distillation. The divinylacetylene forms stable tetra and octobromides which crystallize well from alcohol and have definite melting points. When allowed to stand even in sealed tubes the oil slowly changes to a gel and finally to a solid which is extremely explosive. If the original substance is put back into the copper mixture mentioned above it can be kept indefinitely for use when needed by distilling it off at a temperature not exceeding 13° C. When cupric chloride is added to the mixture dichloroethylene is formed, and no hydrocarbons.

The application of the Friedel and Craft reaction to non-benzenoid compounds: JAMES F. NORRIS and RAM PRASAD. Continuation of previous work showed that benzoyl chloride condenses, under the influence of aluminium chloride, with ethylene, propylene, butylene, isobutylene, trimethylethylene and isopropylethylene. The product of the reaction in each case was the unsaturated ketone formed as the result of the replacement of one hydrogen atom in the hydrocarbon by a benzoyl group. Hydrogen chloride addition products of the unsaturated ketones were also formed. Condensation was also effected between benzoyl chloride and malonic ester and diisopropyl. The study of the application of the reaction to saturated hydrocarbons is being continued.

Some condensations with olefines. A contribution to our knowledge of the Friedel-Craft reaction: C. E. BOORD and R. S. HANSON. Olefines condense in the presence of anhydrous aluminum or ferric chloride to form oily addition products. These addition products are very reactive, undergoing the following series of transformation: (1) With benzene they form intermediate condensation products which upon hydrolysis yield alkyl benzenes; (2) with phenol they form intermediate condensation products which upon hydrolysis yield alkyl phenols; (3) by direct hydrolysis by cold concentrated hydrochloric acid they yield alkyl chlorides; (4) with acetyl chloride they yield chloro and unsaturated ketones. Ethylene, butylene and amylene give similar results. A scheme of reactions is given as a simple explanation of the above reactions as well as of the Friedel-Craft synthesis of hydrocarbons. The explanation offered agrees perfectly with that given by Steele for the formation of aromatic ketones by the Friedel-Craft reaction.

The action of titanium tetrachloride upon certain organic compounds: JOSEPH F. HASKINS and WILLIAM MCPHERSON. The work described in this paper is the outgrowth of an attempt to prepare an optically active compound of titanium. In the course of this work it was found necessary to study more in detail the fundamental reactions between titanium tetrachloride and representatives of the important groups of organic compounds. The paper gives the results of some of these experiments. Among other reactions, it was found that titanium tetrachloride could be substituted for aluminum chloride with advantage in the synthesis of certain compounds by the Friedel-Craft reaction. For example, benzoyl chloride and benzene in the presence of titanium tetrachloride react to give benzophenone a reaction which serves as a good laboratory method for preparing this substance. The work is being continued.

A comparison of ferric and aluminum chlorides in their action on chloral, bromal and organic compounds: G. B. FRANKFORTER and E. E. HARRIS. A continuation of the work of Frankforter and Kritchevsky. The two chlorides have been compared in their condensing properties, using chloral and bromal with the phenolic ethers and other organic compounds. Among the most important compounds prepared are the following: Diphenetyltribromoethane, tetrabromodiphenetyltetrabromoethane, diphenetyldibromoethylene, diphenetyldiethoxythylene, diphenetyldiacetoacetylethylene, dibromophenetyldibromoethylene, tetraphenetyldimethylacetylene. The properties of these compounds have been carefully worked out in addition to the comparison of the action of the two chlorides in their preparation.

Optically active dyes: A. W. INGERSOLL and ROGER ADAMS. A study of the action of optically active dyes on fibers should throw light on the mechanism of dyeing. The preliminary work of which this is a report has involved the study of an easy method for preparing pairs of active dyes. An extremely convenient way has been found by first synthesizing and resolving into optically active isomers certain amino acids, in particular phenyl amino acetic acid. These amino acids can be converted into dyes by the following general reactions which take place very satisfactorily in the laboratory:

$$\text{R-CH-CO}_2\text{H} \quad \text{R-CH-CO}_2\text{H}$$
$$\text{NH}_2 \qquad \text{NHCOC}_6\text{H}_4\text{NO}_2(\text{p})$$

$$\text{R-CH-CO}_2\text{H} \quad \text{R-CH-CO}_2\text{H}$$
$$\text{NHC}_6\text{H}_4\text{NH}_2 \qquad \text{NHCOC}_6\text{H}_4\text{N}_2\text{Cl}$$

Dyes.

The oxidation of lactose, d-glucose and d-galactose with potassium permanganate: C. A. BUEHLER and W. L. EVANS. (*a*) These carbohydrates are oxidized by permanganate solutions to carbon dioxide, acetic acid and oxalic acid, the presence of the latter being determined by the concentration of the alkali present and also by the time of the reaction. The oxalic acid production shows a maximum point and the carbon dioxide a minimum point. (*b*) Mixtures of d-glucose and d-galactose equivalent to a lactose solution of a given concentration are not oxidized to the same amounts of the reaction products as the disaccharide at the same concentration of alkali. (*c*) The amounts of the reaction products obtained from the two hexoses at 25° and 50° are not the same, while at 75° they are nearly equal.

Some relationships of the work on halogenated phenols: W. H. HUNTER. The work on halogenated phenols at the University of Minnesota gives promise of giving information on the following problems: (1) Substitutes in phenols; (2) oxidation of phenols; (3) reactions of unsaturated radio; (4) rearrangements related to the benzidine rearrangement; (5) relation between para (and ortho) groupings.

A method of measuring the reactivity of the halogen atoms in organic chlorides: J. B. CONANT, W. R. KIRNER and A. C. GLENNIE. In order to compare the reactivity of a series of chlorides of the types RCH_2Cl, $R(CH_2)_2Cl$ and $R(CH_2)_3Cl$, it is necessary to have some reaction whose speed can easily be measured and which will not be attended by side reactions. Alkaline reagents and nitrogen compounds are unsuitable, as they cause the formation of unsaturated and cyclic compounds. Potassium iodide in acetone solution has been found satisfactory. The reaction giving the corresponding organic iodide proceeds smoothly. The amount of inorganic iodide used up can be determined by titration. The results show that the reaction is bimolecular. The temperature coefficient is about normal. The values so far obtained indicate the following relative reactivities at 25° as compared to butyl chloride: BuCl 1.00, $MeS(CH_2)_2Cl$ 1.64, $MeS(CH_2)_3Cl$ 4.5, $PhCH_2Cl$ 149, $NO_2C_6H_4CH_2Cl$ 11,800, $PhCOCH_2Cl$ 33,200.

Molecular structure: Benzene, cyclohexane and naphthalene: JARED KIRTLAND MORSE. Molecular space is considered discontinuous is such a way that the ratio of the distances between any three points on a straight line is rational. For a given molecule the number of these point positions is restricted by the valency condition that all saturated atoms (carbon and above in atomic number) have eight valency electrons equidistant from the nucleus. By applying these criteria, models have been constructed for cyclohexane, benzene and naphthalene, from which can be derived the geometric properties of the dynamic isomers, the relations between chemically related compounds and the mechanism by which molecules form crystal lattices. For naphthalene the crystal lattice agrees with Bragg's X-ray measurements but not with his molecular theory. Cyclohexane has a simple cubic lattice containing one molecule, benzene a centered orthorhombic lattice containing two molecules. A method for calculating the lattice constants, axial ratios and densities of solid benzene and cyclohexane from the density and crystallographic data for naphthalene is given. Cyclohexane: Calc.—lattice constant 5.697×10^{-8} cm., density (solid) 0.75. Obs. density (liquid) Young 10.7° 0.78715 M.P. 4.7°. Benzene: Calculated; lattice constants 5.697×10^{-8} cm.; 6.996×10^{-8} cm.; 6.137×10^{-8} cm.; density 1.0531; axial ratios 0.814 : 1 : 0.877. Observed; axial ratios Groth 0.799 : 1 : 0.891; density Richards 1.0513. Calculated diameter spherical benzene gas molecule 6.86×10^{-8} cm. Effective diameter on collision from kinetic theory using Schumann's viscosity measurements vapor 20°, 6.78×10^{-8} cm.

Some derivatives of the lactone produced by condensing cyclo-hexene oxide with malonic ester: E. C. KENDALL and A. E. OSTERBERG. Tetrahydro benzene adds hypochlorous acid to form ortho-chloro-cyclohexanol. This with sodium hydroxide forms cyclo-hexene oxide, which condenses with sodium malonic ester in the same way that ethylene oxide does. The resulting lactone reacts with additional sodium ethylate giving a product which will react with alkyl halides. The properties of the resulting compounds as well as those of certain nitrogen derivatives obtained from the lactones and ammonia have been studied.

Derivatives of 2,4-dinitrobenzaldehyde: T. B. DOWNEY with ALEXANDER LOWY. 2,4-Dinitrobenzaldehyde was condensed with a number of aromatic amines, phenols and their derivatives, giving monomolecular and dimolecular condensation

products. Monomolecular condensations were effected with tolidine (also addition product), p-aminoazobenzene, chloroanilines, etc. Dimolecular condensations were effected with phenol, o-chlorophenol, resorcinol, bromoresorcinol, guaiacol, dimethylaniline, diethylaniline, etc. Some of the products are dyes and indicators.

The quantitative determination of acetic anhydride: G. C. SPENCER. The proposed method is based upon the action of acetic anhydride and aniline in cold chloroform. An equivalent amount of acetanilide forms. Slight amounts of alcohol and water as found in U. S. P. chloroform do not interfere. The first attempts were made to separate the acetanilide by washing the chloroform solution with dilute sulfuric acid to remove aniline separating the chloroform solution, and evaporating to dryness in a tared beaker. The gravimetric method was unsatisfactory. The method adopted was to hydrolyze the residual acetanilide with 10 per cent. sulfuric acid and titrate the resulting aniline sulfate with half-normal potassium bromate-bromide solution. Results satisfactory for both high and low concentrations of acetic anhydride.

The estimation of aliphatic nitrate esters in the presence of certain nitro-aromatic compounds: WILBERT J. HUFF and RICHARD D. LEITCH.

On the basis for the physiological activity of certain onium compounds. I. Nitrogen derivatives: R. R. RENSHAW and J. C. WARE. The possible bases for the different types of physiological action of the simple and the substituted tetraalkyl ammonium compounds are briefly considered. The following new substances are described: Iodo methyl acetate, acetyl formocholine salts, methoxymethyl dimethyl amine, beta-dichloroarsine-ethyl trimethyl ammonium chloride, beta-arsenous oxide-ethyl trimethyl ammonium chloride. Improved methods for the preparation of formocholine and certain other choline derivatives are given.

Deaminization of methyl-cis-3-amino-1,212-trimethyl pentanoate: GLENN S. SKINNER. The decomposition of this ester with nitrous acid has been carried out on a large scale. Reaction products are formed in the following proportions: Methyl esters of unsaturated acids, 62 per cent.; methyl esters of hydroxy acids, 36 per cent.; methyl esters of chloroacids, 2 per cent. The unsaturated ester upon saponification gave lauronolic acid which was identified by conversion to the bromolactone. Three crystalline hydroxy acids have been isolated from the saponification products of the various fractions obtained by distillation under diminished pressure. One of these acids has a tertiary beta-hydroxyl and is identical with the acid of M. P. 101-2°, obtained by the decomposition of the methyl ester of the trans-isomeric amino acid. A second hydroxy acid of M. P. 121° has a secondary hydroxyl as shown by oxidation with Beckmann's chromic acid mixture. The third hydroxy acid of M. P. 208-10° also has a secondary hydroxyl and is optically inactive. d-Ciscamphonolic acid could not be isolated. No ether acid was formed whereas the methyl ether d-ciscamphonolic acid constitutes 13 per cent. of the decomposition product of the methyl ester of the trans isomeric amino acid.

Ammono formaldehydes: EDWARD C. FRANKLIN. The ammonia analog of formaldehyde, compound of the formula $CH_2{=}N{-}CH_2{-}N{=}CH_2$, is only known in the form of its dimer, hexamethylene tetramine. The methods of formation and the properties of hexamethylenetetramine are in harmony with the view that it is a polymeric form of an ammono formaldehyde. Hydrocyanic acid, represented by the form HCN, is also to be looked upon as an ammono formaldehyde. It undergoes polymerizations and condensations, reacts with acid sulfites and hydroxylamine, and otherwise behaves in a manner closely resembling the well-known behavior of ordinary formaldehyde.

International numberings of ring complexes: AUSTIN M. PATTERSON and CARLETON E. CURRAN. There is at present no uniform system for numbering parent cyclic compounds. The authors have drawn up a simple set of rules for such numbering, with the avowed purpose of preserving as many as possible of the accepted numberings, while achieving consistency. About three fourths of the numberings used in Richter's "Lexikon," Meyer and Jacobson's "Lehrbuch," and the *Chemical Abstracts* indexes conform to the proposed rules. The matter has been taken up with the proper committees of foreign chemists with encouraging results. If their cooperation can be secured it is proposed to publish a classified collection of known ring complexes, the number of which now approaches a thousand.

Steric hindrance in the migration of acetyl: L. CHAS. RAIFORD and CHAS. M. WOOLFOLK. In previous work (*J. A. C. S.*, 41, 2068) one of us has shown that when an ortho acetylaminophenol is benzoylated by the Schotten-Baumann reaction, benzoyl goes to nitrogen, while the acetyl shifts to oxyxgen. In further study of this behavior the present work was done to learn whether this rearrangement would be prevented by the presence of bromine atoms adjacent to the reacting

groups. Acetyl-benzoyl derivatives were prepared from 2-amino-3, 6-dibromo-4-methylphenol, 2-amino-3, 5, 6-tribromo-4-methylphenol, and 2-amino-3, 4, 5-tribromo-6-methylphenol. In every case the migration was observed, which seems to indicate that the bromine atoms cause no hindrance. The amino cresols used in this work were secured through the nitration of the corresponding brominated ortho and para cresols. When tetrabromo-o-cresol was nitrated by Zincke's method (*J. Pr. Ch.*, (2) 61, 564) we obtained two isomeric mononitrotribromo-o-cresols, in which we were able to prove that the hydroxyl and nitro radicals occupied ortho and para relationships, respectively, in the two compounds. In this nitration Zincke was able to isolate only one of these substances—the ortho product.

The hydrolysis of alkyl sulfates. II: RUSSELL MORGAN and H. F. LEWIS. The hydrolysis of dimethyl sulfate under the influence of acids, alkalis and salts is described and the following conclusions are drawn: (1) The higher the dimethyl sulfate : water ratio in the water hydrolysis, the more rapid the hydrolysis; (2) strong acids in low concentration increase the rate of hydrolysis, but in high concentration retard it; (3) the tendency in alkaline solution is for the second alkyl to come off less easily. No difference between NaOH and KOH in low concentration; (4) acetic acid greatly depresses hydrolysis; (5) salts depress the rate of hydrolysis, even preventing the splitting off of the first group; (6) the only substances acting as positive catalysts are the dilute mineral acids, a large number of which have been studied.

The interaction of primary aliphatic alcohols and beta-gamma-dibromopropyl-thiocarbimide: RAYMOND M. HANN. Primary aliphatic alcohols react with this substance to form 2-hydroxy-5-bromomethyl-thiazoline,

$$\begin{matrix} BrCH_2—CH—S \\ CH_2—N=C—OH \end{matrix}$$

This result is contrary to that assumed by Dixon and also to the correction of Dixon's work by Gabriel, who assumed that the product was

$$\begin{matrix} BrCH_2—CH—S \\ CH_2—N=C—OEt \end{matrix}$$

Aluminum arylamines: M. L. CROSSLEY. Aluminum reacts with primary and secondary arylamines producing aluminum arylamines and hydrogen. Tertiary amines do not react with aluminum. Mixtures of the three types of amines can be separated by refluxing with aluminum, distilling off the tertiary amine and recovering the primary and secondary amines from the residue. The aluminum compounds are readily decomposed by water and alcohol, giving the original amines, aluminum hydroxides and small quantities of secondary products such as diphenylamine. The aluminum compound is very reactive and makes possible the introduction of alkyl and aryl groups under atmospheric pressure.

The action of nitrogen trichloride upon unsaturated hydrocarbons: G. H. COLEMAN and H. P. HOWELLS. Nitrogen trichloride reacts with amylene in carbon tetrachloride to form ammonium chloride and nitrogen gas. No more than traces of other nitrogen compounds are obtained. With butylene nitrogen forms, in addition to ammonium chloride and nitrogen, a n-chloroamine in about 20 per cent. yield. When this product is shaken with concentrated hydrochloric acid the chlorine atoms attached to nitrogen are replaced by hydrogen. The resulting amine still contains chlorine attached to carbon. With propylene the reaction takes place more slowly but the products are similar to those from butylene. A possible explanation of the failure of amine formation in case of amylene is offered.

The equilibrium between benzoin and benzaldehyde: ERNEST ANDERSON, R. A. JACOBSON and M. J. STUTZMAN. The benzoin condensation is found to be reversible. An equilibrium is reached between benzaldehyde and benzoin when either substance is dissolved in alcoholic sodium cyanide. Both pure substances can be recovered from such solutions. The equilibrium is of the general type A = 2B. The amounts of benzaldehyde and benzoin present at equilibrium in various mixtures check closely with the amounts calculated from the equilibrium constant.

Di-beta-hydroxyethyl aniline and some of its derivatives: F. W. UPSON and D. W. MCLAREN. This substance has been obtained in 70 per cent. yield by refluxing one mol. of aniline with three mols. of ethylene chlorohydrine in the presence of 30 per cent. aqueous sodium hydroxide. The product is obtained by ether extraction and fractional distillation of the extract under reduced pressure. Phenyl morpholine has been obtained by a similar process from beta-beta-dichloro diethyl ether. Di-beta hydroxyethyl aniline and phomo-morpholine have been coupled with diazotized sulfanilic acid giving color substances related to methyl orange.

The preparation of pure ortho and para xylenes: H. T. CLARKE and E. R. TAYLOR. The literature dealing with the separation of the xylenes is contradictory and misleading. It has been found

that fractional distillation, selective sulfonation, crystallization of the sulfonic acids and selective hydrolysis of the xylene sulfonic acids all tend to bring about a partial separation of the three xylenes present in coal tar xylene, but that none of these processes alone is entirely suitable for the isolation of the ortho and para derivatives. A satisfactory procedure is described in which the above processes are combined.

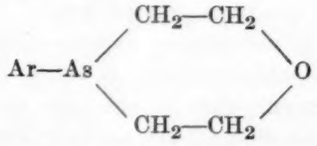
The preparation of tetramethylene bromide: C. S. MARVEL and A. L. TANENBAUM. Tetramethylene bromide is a research chemical often needed. Several methods have been devised for its synthesis, but none of these is satisfactory. It has been found possible to obtain the substance easily by the following reactions: $Br(CH_2)_3Br + C_6H_5ONa$ — $Ph\text{-}O(CH_2)_3Br$, + NaCN + EtOH + H_2SO_4 — $Ph\text{-}O(CH_2)_3CO_2Et$, + Na + EtOH — $Ph\text{-}O(CH_2)_3CH_2OH$, + HBr — $Ph\text{-}O(CH_2)_3CH_2Br$ + $Br(CH_2)_4Br$. The yields in the steps are 80, 90, 80, 65, 40 and 40 per cent. respectively. As will be noticed the yields are good in every step except the last, where equal amounts of phenoxybutyl bromide and tetramethylene bromide are obtained. The former can be converted into the latter by prolonged treatment with hydrobromic acid. Hydriodic acid reacts like hydrobromic acid, giving about the same yields of the iodine compounds.

Some derivatives of ethylbenzene: F. W. SULLIVAN, JR. Ethylbenzene was prepared in good yield by the action of ethylene on benzene in the presence of aluminum trichloride. It was found that chlorine acts on boiling ethylbenzene giving alpha chloroethyl benzene and not the beta compound as is stated in the literature. The corresponding bromide was prepared. Both give phenyl methyl carbinol on hydrolysis. They also give an acetate when boiled with sodium acetate in glacial acetic acid. Styrene is obtained by passing the vapors of chloroethyl benzene over soda lime. The same substance is obtained in quantitative yield when the chloro compound is heated with quinoline. Ethyl benzene gives very good yields of the nitro derivatives when nitrated according to the standard procedure for the nitration of toluene.

The preparation of aromatic alpha hydroxy acids and their esters from the cyanhydrins: G. E. SEIL and IS. KALUGAI. Seil's method of hydrolysis of the cyanhydrins by means of sulfuric acid dihydrate was used on mandelic nitrile prepared from benzaldehyde. The yield of mandelic acid was 83 per cent. The ethyl ester was prepared by different methods. The isopropyl ester of mandelic acid was synthesized and its properties were determined.

The preparation of methyl red: A. W. SCHORGER. Methyl red is prepared by diazotizing anthranilic acid and coupling with dimethylaniline, following in general the procedure of Tizard and Winmill. Free methyl red in the form of violet crystals is best obtained by crystallization from acetic acid, the crystals retaining two molecules of the solvent. From the standpoint of ease of crystallization and purity of product, the best procedure is to crystallize from dilute hydrochloric acid, obtaining the hydrochloride of methyl red. The sodium salt has also been prepared and like the analogous compound, methyl orange, is readily soluble in water.

New heterocyclic arsenic compounds: C. S. PALMER. In the presense of two moles of sodium ethylate, one mole of primary arsine condenses with one mole of beta-beta-dichlorodiethyl ether or gamma-gamma-dichlorodipropyl ether to give compounds such as



The products are high-boiling, stable oils. They give the reactions of tertiary arsines, the arsenic readily passing to the pentavalent state by the addition of oxygen, sulfur, halogens, alkyl halides. Chloroplatinates and mercurichlorides are also formed. The above synthesis is a new reaction of primary arsines. Preliminary experiments show that the method can be applied to secondary arsines and to other halides as well as to dihalogenoethers.

Action of arsenious chloride on quinoline: JOHN H. SCHMIDT. (By title). Carbostyril and a product which preliminary analyses indicate to be tricarbostyril arsonic acid have been prepared by the action of arsenious chloride upon quinoline at comparatively high temperatures. Further investigation of this reaction is in progress.

On the basis for the physiological activity of certain onium compounds. II. Arsenic derivatives: R. R. RENSHAW and E. R. WAGNER. Several new arsonium compounds are described. Trimethyl arsine dihalides condensed with ethylene and with formaldehyde to form the arsenic analog of neurine and formaldehydo trimethyl arsonium halides respectively.

The behavior of the mercuric salts of carboxylic acids toward heat and the structure of mercuric cyanide: MORRIS S. KHARASCH and

FREDERICK W. STAVELY. The behavior of the mercuric salts of various substituted acetic acids toward heat has been investigated. It has been found that the reaction products depend to a very large extent upon the nature of the substituted groups. In the case of the mercury salts of alkyl substituted acetic acids the mercury either replaces a hydrogen of the alpha carbon atom, or, if there is none available, no reaction takes place (compare, however, the behavior of trichloroacetic acid). In the case of the mercury salts of the phenylated acetic acids the mercury enters the ortho position in the benzene ring. However, upon heating the mercury salts of substituted acetic acids, which lose carbon dioxide upon heating rather easily, a different reaction takes place: the mercury usually taking the place originally occupied by the carboxyl groups. Thus, dimethyl and diethyl acetoacetic acids behave that way. The stability of the various compounds, prepared in the course of this work, towards various reagents has also been studied, and the significance of the tests pointed out.

The action of mercury on certain alkyl iodides and substituted alkyl iodides: J. LOUIS MAYNARD. During the present work it has been shown that the direct union of metallic mercury and methyl iodide is not hastened by ultraviolet light but is hastened by a specially arranged arc light. The reaction is preceded by the formation of a small amount of mercurous iodide. If mercurous iodide is used with methyl iodide, methyl mercuric iodide is formed rapidly. The action of metallic mercury is confined almost entirely to methyl iodide. The use of mercurous iodide makes possible the extension of the reaction to higher iodides and even to benzyl iodide. The work is being extended both to a study of the limits of the reaction and of the particular wave lengths which increase the speed of the reaction.

The structure of the compounds from mercuric salts and olefines: ROGER ADAMS, F. L. ROMAN, W. M. SPERRY. Two different general formulas have been suggested for the products of mercury salts and olefines, true addition compounds such as $HOCH_2CH_2HgX$, and molecular compounds such as $CH_2{:}CH_2{:}Hg(OH)X$. The former have been shown to be correct by a study of the action of mercury salts on o-allyl phenols, which give products for which no reasonable "molecular" formulas can be written. o-Allyl phenol reacts with mercuric chloride to form 2-chloromercurimethyl-2, 3-dihydro-benzofuran and hydrochloric acid. Treatment of this product with sodium amalgam gives the corresponding mercuribis compound. Treatment with potassium iodide and iodine gives the corresponding iodomethyl compound which, on reduction, gives 2-methyl-2, 3-dihydrobenzofuran. Allyl amine and mercuric chloride give a substance of the following structure which also can not be easily explained on the basis of a "molecular" formula:

$$ClHg—CH_2—CH—CH_2NH.HCl—$$
$$HCl—NH—CH_2—CH—CH_2—HgCl$$

The electromotive force of organic compounds: Aldehydes: S. B. ARENSON and D. J. BROWN.

The polymerization of the amylenes: JAMES F. NORRIS and J. M. JOUBERT. The action of various concentrations of sulfuric acid on the five amylenes was studied. Trimethylethylene and unsymmetrical methylethylethylene were the most soluble and the most readily polymerized. In the case of these hydrocarbons no alkyl sulfuric acids were formed. The mechanism of the polymerization appears to consist in the dehydration of the alcohol first formed from the hydrocarbon. Isopropylethylene was the only isomer which was polymerized without previous solution in the acid. The study of the products formed as the result of the decomposition of the ozonides of the polymers led to conclusions as to the structure of the dimers of trimethylethylene and isopropylethylene. Improved methods of preparation of the compounds studied were found.

The relationship between structure and oxidation potential of quinones: J. B. CONANT and L. F. FIESER. The oxidation-reduction potential of a number of quinones is being measured in alcoholic hydrochloric acid by a titration method. The results at 25°, expressed on the hydrogen electrode scale for certain typical quinones are: benzoquinone 0.711, 1, 2-naphthoquinone 0.579, 1, 4-naphthoquinone 0.484, phenanthraquinone 0.471, anthraquinone 0.155. Measurements of various derivatives show that substitution of hydrogen by Cl, SO_3H, CO_2H or CO_2R increases the potential, substitution by alkyl lowers it. The effect of substituents is not entirely cumulative as the following values obtained with chloroquinones show: monochloro 0.736, 2, 6-dichloro 0.746, 2, 5-dichloro 0.707, tetrachloro 0.695.

The oxidation of tribromoaniline: W. H. HUNTER and A. G. MAYERS. The oxidation of 2, 4, 6-tribromoaniline by chromic acid yields almost quantitatively the 2, 4, 6-tribromoanil of 2, 6-dibromquinone. This reaction may be formulated as a benzidine rearrangement, or as a reaction of unsaturated radicals.

The oxidation of d-mannose with potassium permanganate: W. L. EVANS and R. A. CRAWFORD. The oxidation of d-mannose with alkaline potassium permanganate at 50° proceeds with the production of carbon dioxide, oxalic acid and acetic acid. The relative amounts of these products depend on the concentration of alkali used. In neutral solutions only carbon dioxide and acetic acid are formed. At low alkalinities, all three are formed, the carbon dioxide falling off rapidly and the oxalic acid rising rapidly with an increase in alkalinity to about 0.15 N, after which carbon dioxide increases slowly and the oxalic acid decreases slowly to 1.0 N alkali. Above this point the relative amounts of carbon dioxide and oxalic acid remain practically constant. Acetic acid remains almost constant over the whole range.

Catalytic ammonolysis of beta-naphthol in the vapor state: A. M. HOWALD with ALEXANDER LOWY. Mixtures of ammonia gas and beta-naphthol vapor were passed over a number of anhydrous oxide catalysts in a Pyrex tube at definite temperatures. A study of the yield of beta-naphthylamine was made as dependent on temperature, catalyst, rate of flow and ratio of reactants. Over a considerable range of conditions, yields in excess of 90 per cent. were obtained, together with some beta-dinaphthylamine. Curves illustrating a marked effect of temperature on catalyst efficiency are shown.

Deaminization of the methyl and ethyl esters of dl-alanine and aminoisobutyric acid: A. L. BARKER and GLENN S. SKINNER. The methyl and ethyl esters of aminoisobutyric acid yielded largely the esters of alpha-methyl acrylic acid together with a small amount of hydroxy isobutyric acid. The methyl ester yielded 3 per cent. of acid material which contained, according to the Zeisel determination, 70 per cent. of the ether acid. The ethyl ester yielded 0.5 per cent. of acid material which contained 30 per cent. of ether acid. The esters of alanine yielded the unsaturated, chloro and hydroxy esters together with a high boiling nitrogenous residue. The methyl ester gave 15 per cent. of acid material, of which 60 per cent. was the ether acid. The ethyl ester gave 2 per cent. of acid material containing 70 per cent. of ether acid.

The recovery and refining of pyridine: WILBERT J. HUFF.

Intermediate complex formation and electronic valence: BEN H. NICOLET. Ortho and para iodoamines have their iodine in a mobile state which may be described by calling the iodine "positive." Two nitro groups, when o-p, produce an even more recognizably negative halogen. But, although two nitro groups thus exceed one amino group, 3, 5-dinitroiodobenzene shows no test for positive iodine; and yet, 3, 5-diamino-chlorobenzene, boiled with alcoholic sodium ethylate, shows no trace of negative chlorine. It is concluded that certain conditions favoring formation of necessary "intermediate complexes" are necessary for reaction, and that such considerations must be taken into account in judging electronic structures.

The catalytic synthesis of the acetals and their halogenation: JOSEPH S. REICHERT, JAMES H. BAILEY and J. A. NIEUWLAND. The acetals were prepared by passing acetylene into the corresponding alcohols in the presence of concentrated sulfuric acid and a mercury salt as a catalyst. The products of the chlorination and bromination of dimethyl and diethyl acetals were determined. The chlorination of diethyl acetal gave a good yield of chloral. Chloral was also prepared by the successive action of acetylene and chlorine on ethyl alcohol. After the required amount of acetylene had been absorbed, the reaction mixture was chlorinated directly without the separation of the acetal. In this process one mol. of acetylene takes the place of one mol. each of alcohol and chlorine as compared to the ordinary process of making chloral from alcohol.

New derivatives of 2-bromo-5-hydroxy-1, 4-naphthoquinone: ALVIN S. WHEELER and B. NAIMAN. The preparation of 2-bromo-juglone as given by Wheeler and Scott was improved upon. Its benzoate was prepared. Its bromine was replaced by chlorine by means of alcoholic hydrochloric acid. The benzoate of the chloro compound was prepared. A dibromojuglone was made by brominating a hot glacial acetic acid solution of the monobromo compound. The second bromine entered the quinone ring and none entered the phenol ring in spite of the fact that juglone readily takes up two in the quinone and one in the phenol ring. Both bromines can be replaced by chlorine by means of alcoholic hydrochloric acid. Acetates and benzoates were prepared.

The polymers of pinene. II: G. B. FRANKFORTER and BETTY SULLIVAN. Improved methods have been worked out for the preparation of the compounds already described, namely, colophene, $(C_{16}H_{16})_2$, and colophonene, $(C_{10}H_{16})_5$, together with new derivatives of the same. In addition to the above, new compounds have been obtained which complete the series, namely, the

sesquicolophene, $(C_{10}H_{16})_3$, and the dicolophene, $(C_{10}H_{16})_4$. The properties of the latter resemble the former in their remarkable stability and in the difficulty with which they form derivatives.

Some sulfonic acid esters of phenylazophenol and its substitution derivatives: C. E. BOORD, M. D. COULTER and HELEN L. WIKOFF. (Lantern). Several esters of benzene sulfonic acid, p-toluene sulfonic acid and alpha naphthalene sulfonic acid with phenylazophenol and its substitution products were prepared by the Baumann-Schotten method. The twenty-one esters thus prepared for the first time, together with the fourteen previously described (*Ber.*, 28, 800, 31, 1782, 2116; *J. Pr. Ch.*, 78, 386), are all stable, easily purified, beautifully crystalline compounds melting between 50° and 200°. It is suggested that this type of derivative may be of value in characterizing the sulfonic acids. The para derivatives such as p-tolylazophenol and p-chlorophenylazophenol seem best adapted to this purpose.

Practical preparation of oxalic acid from acetylene: SISTER MARY LUCRETIA, LEO J. HEISER and J. A. NIEUWLAND. Oxalic acid can be prepared on a practical scale by passing acetylene into a mixture containing three volumes of nitric acid to one volume of water and about two per cent. mercuric nitrate. The formation and loss of nitrogen oxides in the reaction prevents the commercial use of the process. The reaction proceeds through the formation of an intermediate compound which yields aldehyde, which is then oxidized to oxalic acid. Oxalic acid can be prepared by the direct action of nitrogen oxides on acetylene, by the action of acetaldehyde with nitric acid (3 : 1), and by the action of nitrogen oxides on aldehyde vapor. Acetaldehyde can be prepared by the action of acetylene on dry mercuric nitrate, by the action of acetylene on the compound obtained by treating metallic mercury with nitrogen oxides.

The oxidation of propylene glycol with lithium, sodium and potassium permanganates: E. C. HYTREB and W. L. EVANS. (*a*) Propylene glycol is oxidized by neutral permanganate solutions to carbon dioxide and acetic acid at 25° and 50°. Above certain minimum concentrations of alkali oxalic acid is also obtained. (*b*) The amount of each oxidation product at low alkalinities is influenced not only by the concentration of the alkali, but also by the use of either lithium, sodium and potassium hydroxides in connection with each of the several permanganates.

Hexabromodiphenyldisulfide: W. H. HUNTER and A. H. KOHLHASE. This compound is obtained by treating the silver salt of tribromothiophenol with iodine in benzene solution. This action is normal, and by so much is contrary to the action of iodine on the salts of halogenated phenols to form polyphenylene oxides. Further, molecular weight determinations in various solvents give consistently low results, apparently showing dissociation of the substance and consequent existence of the free radical $C_6H_2Br_3S$, which does not lose halogen spontaneously.

Formation of goumaric acids and substituted gamma-butyric acids from resorcinol, orcinol and phloroglucinol: W. D. LANGLEY and ROGER ADAMS. While attempting to prepare certain complex ketones, it was found that beta-chloropropionitrile and gamma-chlorobutyronitrile do not condense with resorcinol, orcinol or phloroglucinol in the presence of zinc chloride and hydrogen chloride as nitriles ordinarily do to give ketones, but instead condense to give acids, $(HO)_2C_6H_3CH_2CH_2CO_2H$, etc. Alpha-beta-unsaturated nitriles give the same type of condensation product, indicating without doubt that with these compounds the first step is the addition of hydrogen chloride to the double bond.

A new method of preparing unsaturated 1,4-diketones: J. B. CONANT and R. E. LUTZ. Substances of the general type RCOCH=CHCOR are of interest because they contain the characteristic linkage of quinone and indigo. Only a relatively few representatives have been previously prepared and the methods of preparation are difficult. We have prepared a number of aryl unsaturated 1, 4-diketones by the action of fumaryl chloride, aluminum chloride, and an aromatic hydrocarbon. The yields are good. It is interesting that these substances are all smoothly reduced to the corresponding ethane derivatives by sodium hydrosulfite or titanous chloride in contrast to ketones of the type RCH=CHCOR, or acids of the type $HO_2CCH=CHCO_2H$, which are not reduced by these reagents.

The preparation of hydroxypyruvic acid: W. L. EVANS and G. P. HOFF. The following steps were used: (1) pyruvic acid, (2) monobromopyruvic acid, (3) its methyl ester, (4) methyl ester of hydroxypyruvic acid, (5) hydroxypyruvic acid. The conversion of (3) to (4) was accomplished by means of methyl alcohol and potassium formate, (5) is easily obtained from a slightly acidulated aqueous solution of (4).

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Secretary